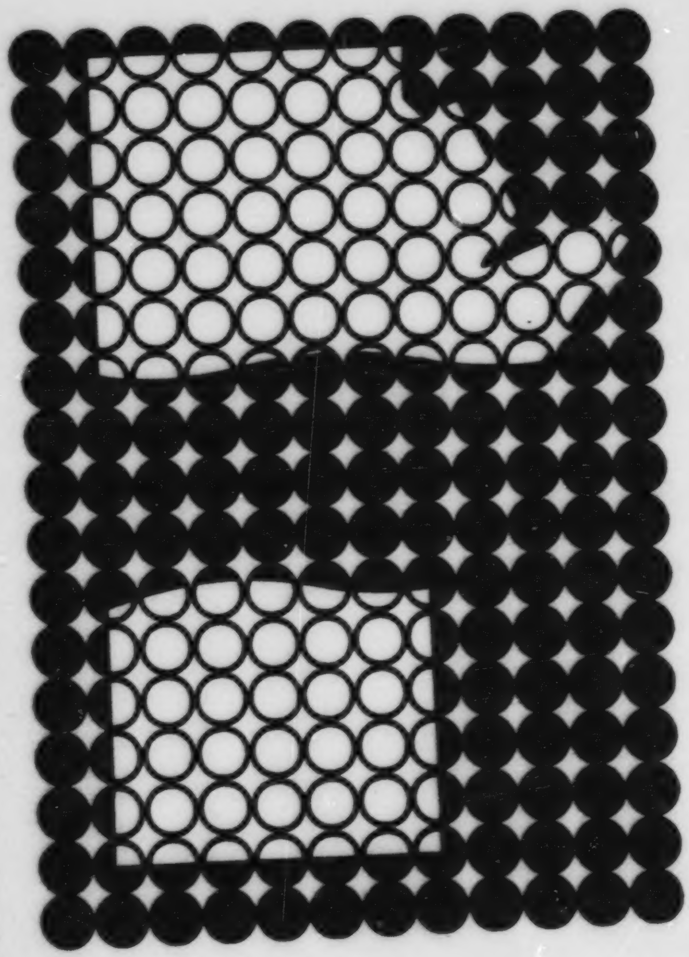

CANADA–MANITOBA
Soil Survey

Soils of the Snow Lake Area

Report D69

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SOILS OF THE SNOW LAKE AREA

BY

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91-05558/

PREFACE

This interim report and map of the detailed field study of the soils of the Snow Lake study area are one in a new series of such soil survey reports covering special interest areas in Manitoba. These reports reflect the growing concern by various government agencies that support the Canada-Manitoba Soil Survey, that a knowledge of the soils of Manitoba is the key to understanding their properties, behavior and response to management. This concern requires that soils be described both in terms of their basic properties and the nature of the environmental setting in which they are found. Thus, when an area such as that in the Snow Lake study requires delineation of land of high or low value for crop production or for other uses, the basic reference document is a reliable soil map.

The land resource information included in this detailed survey covers approximately 3800 ha of terrain around the town of Snow Lake. It includes a small fraction of the area previously covered in the reconnaissance survey of the Cormorant Lake Map Sheet Area (Tarnocai, 1975). However, the projected, more intensive use of the soils for town development and use as industrial sites has created a need for more detailed soil information. The increased examination of soils in the field, the use of current aerial photography, the use of improved methods of studying soils in the laboratory and the accumulated knowledge of the properties and uses of soils over the years have all contributed to the additional information contained in this new series of reports and maps.

During the course of the resurvey of the study area, a significant volume of site specific data for the soils mapped in the area was generated, that for practical reasons cannot be included in this interim report. These data are currently being input into the Canada Soil Information System (CanSIS) data bank. This computerized system of data management permits automated manipulation and statistical evaluation of large volumes of data for soil characterization and interpretations. These data are available on request. In addition, the cartographic file of CanSIS provides a capability to produce derived maps of various kinds quickly and inexpensively. The types of derived maps that can be generated from the basic soil map include the sixteen interpretations that are provided in tabular form in this report as well as a number of single feature maps for such characteristics as drainage, texture of surface deposits, slope, stoniness, distribution of salinity, etc. A package of interpretive maps and single feature derivative maps can also be made available on request to: The Canada-Manitoba Soil Survey, Dept. of Soil Science, Rm. 362, Ellis Bldg., University of Manitoba, Winnipeg R3T 2N2.

The Canada-Manitoba Soil Survey trusts that this report and accompanying map will be of value to all individuals and agencies involved with the use of land within the map area.

ACKNOWLEDGEMENTS

The report on the soils of the Snow Lake Area was conducted as a joint project of the Canada Department of Agriculture and the Manitoba Department of Agriculture in response to a request from the Municipal Planning Branch.

Grateful acknowledgement is made to the following persons:

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HOW TO USE THIS SOILS REPORT

This soils report contains considerable information about the soils, their origin and formation, their classification and their potential for various uses such as dryland agriculture, irrigation, engineering and recreation. The report is divided into four parts: Part 1 provides a general description of the area; Part 2 describes the methodology used in the study; Part 3 discusses the development, scientific classification and morphological characteristics of the soils in the study area, and Part 4 provides an interpretation of soil properties and associated landscape features as they affect soil capability or suitability for various uses.

The soil map of the study area is included in a pocket of the report folder. The map shows the distribution of soil types and associated landscape features that are significant for potential use as field management units. It provides a linkage from landscapes within the study area to the information contained in the report.

To assist the user in retrieving soil information quickly, the following steps are suggested:

If the project consists of a number of individual maps, proceed with STEP 1; if there is only a single map in the pocket, proceed with STEP 2 to 6.

STEP 1 Consult the index to map sheets _if_ the report contains many maps. Locate the area of interest and note the map-sheet number(s) which identify their location.

STEP 2 Consult the appropriate soil map in the pocket of the report folder. Locate the area(s) of interest on the map and identify the pertinent map unit symbols. Arabic numerals placed as superscripts following map symbols indicate the approximate proportion of each soil type within the map unit.

STEP 3 Consult the extended legend accompanying the soil map for an alphabetical listing of soil symbols giving the soil name, classification, drainage and related information concerning landforms, nature and depth of materials, and dominant vegetation.

STEP 4 For interpretive information about the soils, consult the appropriate Table in Part 4. Criteria utilized as guidelines in making these interpretations are provided in the Appendix.

STEP 5 Further information concerning the morphological properties and extent of the soils is presented in Part 3 where the soils are described alphabetically according to soil name.

STEP 6 Additional site-specific information not contained in this report is available on request from the Canada-Manitoba Soil Survey, Rm. 362, Ellis Building, University of Manitoba: phone 474-6115 or 474-6118.

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PART 1

GENERAL DESCRIPTION OF THE STUDY AREA

1.1 Location and Extent

The Snow Lake study area is located around the town of Snow Lake in northern Manitoba (Figure 1). The area covers approximately 3800 ha, including 683 ha of water (lakes and flooded areas) and 273 ha of townsite, plant site, gravel pit, etc.

This project is a detailed survey, at a scale of 1:20 000, of an area that straddles longitude 100°W and covers small parts of File Lake 63K/16 and Herb Lake 63J/13 N.T.S. 1:50 000 scale map sheet areas. The portion of the study area situated in the File Lake map sheet area has been covered previously by the reconnaissance soil survey of the Cormorant Lake Area (Tarnocai, 1975).

1.2 Population, Transport and Land Use

Population. The Town of Snow Lake was incorporated in 1976, but the settlement has been in existence since about 1930, when mining started in the area. The population of Snow Lake numbers approximately 1 850 people, of which most have a direct or indirect economic affiliation with the mining industry of the area (Anon., 1986).

Transport. Snow Lake is linked via provincial roads 392 and 391 with The Pas and Thompson and other points in Manitoba. Additional road access to parts of the survey area is provided by provincial roads 393 and 395 (Figure 1). A railroad carries ore concentrate to the ore smelter at Flin Flon.

Land Use. Intensive land use within the study area is related to town site development and hard rock mining activities. The townsite, golf course, ballpark and rifle range are located on the east side of the lake. Mines and ore processing facilities are located on the north side of town, south of Snow Lake (Threehouse Mine) and east of Anderson Lake (Stall Lake Mine) (Figure 1). Several borrow pits and refuge dumps are found close to town. Tailings from the plant at Snow Lake have transformed a lake north of town into a tailings flat, which is presently being used as a one-runway airfield.

As a result of extensive geological exploration the survey area is criss-crossed by a large number of cutlines of which some give fairly good foot access to parts of the area, which is generally forest covered except for fen areas and bare bedrock outcrops.

The area lies within the timber berth of Repap Manitoba Inc. at The Pas. The timber is mostly used for pulpwood but some of the timber is used for lumber.

Recreational use of the area in summer is centered around the lake which provides opportunity for swimming, boating and fishing. Winter activities like cross-country skiing are accommodated by a fairly extensive trail network of which some distance is illuminated.

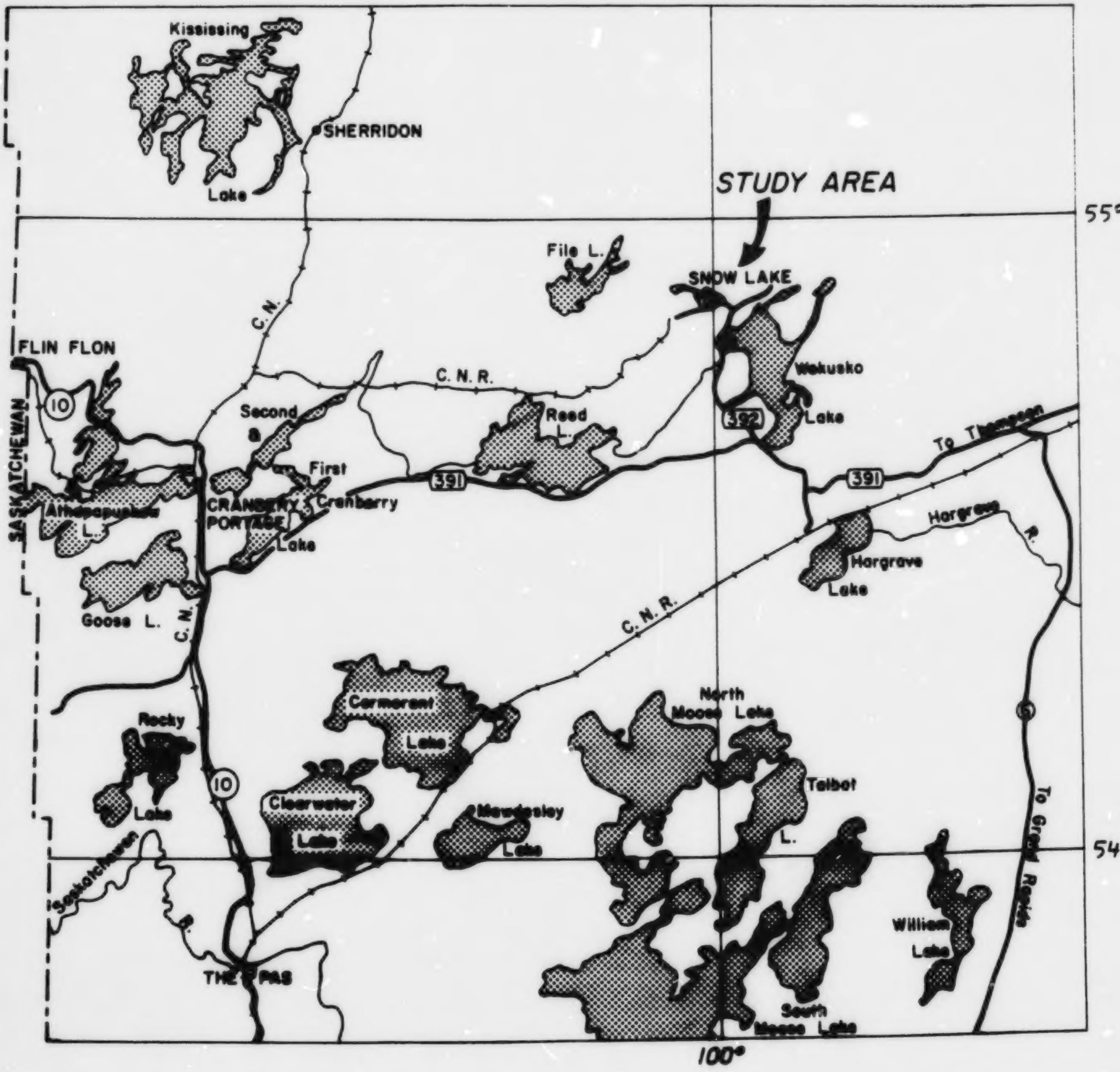


Figure 1. Location of Study Area

1.3 Physiography

The study area lies within the Kazan Upland Division of the Kazan Region, which in turn is part of the Precambrian Shield. More specifically, the study area is part of the Snow Lake Plain subdivision of the Grass-Burntwood River Plain (Mills, 1980) (Figure 2).

The Snow Lake Plain is characterized by the widespread occurrence of acidic, sandy and stony till of granitic origin associated with extensive rock outcrops and locally extensive, moderately calcareous, clayey lacustrine sediments overlain in depressional areas by mesic forest, fibric sphagnum and mesic fen peat.

1.4 Bedrock Geology

The study area lies within the boundaries of the Precambrian Shield. The bedrock underlying the area consists dominantly of partly metamorphosed volcanic bedrock, sedimentary, mafic and ultra-mafic rock and various gneisses (Davies et al, 1962). In general, the bedrock occurs as hills and knobs and is only partially mantled by morainal, lacustrine and organic deposits.

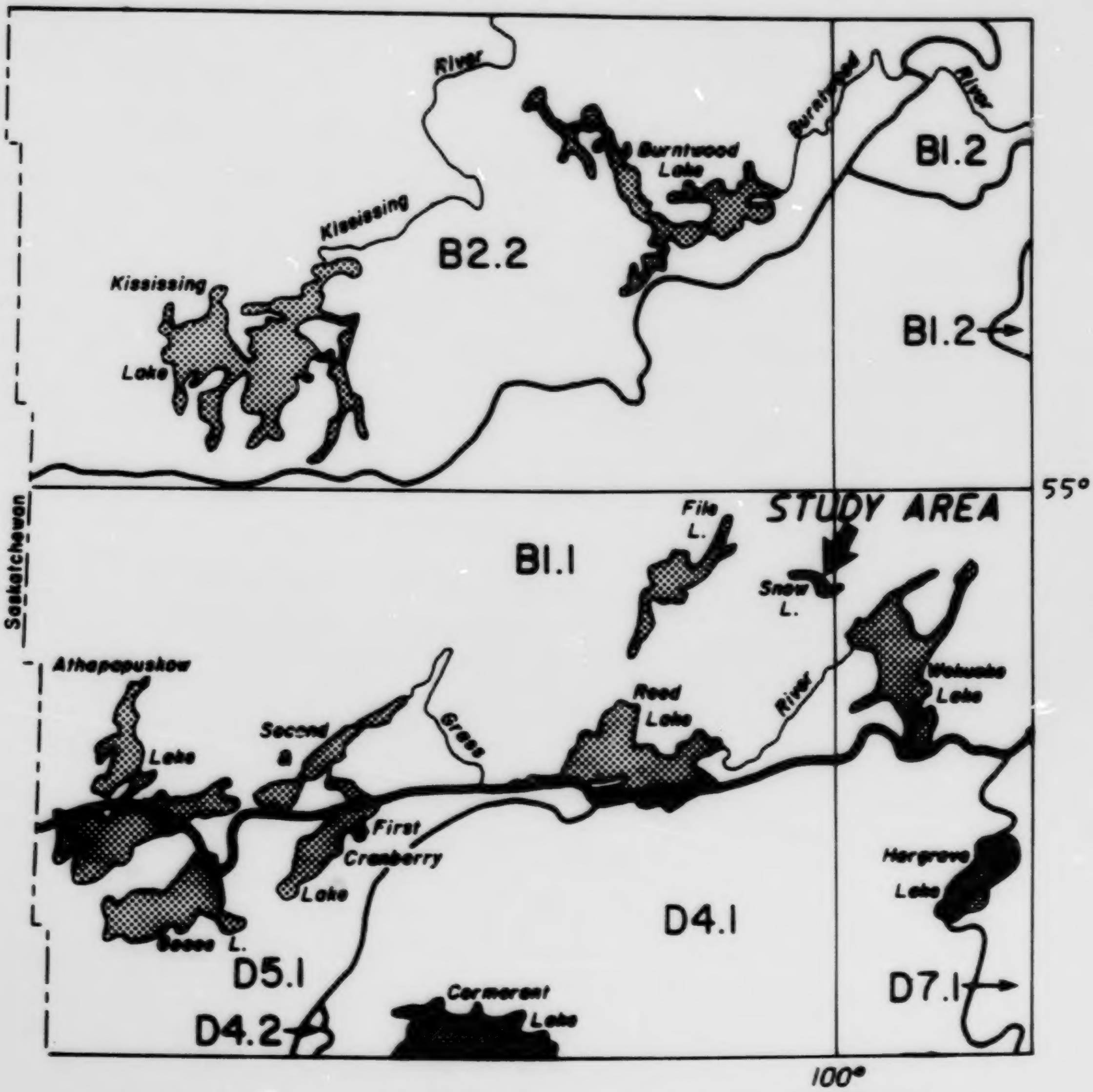
1.5 Surface Deposits

The survey area is typified by broken, hilly to rolling bedrock, which strongly controls relief of the area. The bedrock is only partially mantled by unconsolidated mineral and organic materials. The northwestern section of the area contains extensive lacustrine deposits, while the remainder contains a mixture of lacustrine sediments, till deposits and peatlands (Figure 3).

Till deposits. The area probably was glaciated more than once, but only evidence of the last glaciation, which advanced from the northeast, is still present. The till of the area is generally thin and discontinuous. The deepest deposits are found on the lee side of bedrock outcrops and in bedrock depressions. The texture of the till is primarily sandy loam to loamy sand. Varying quantities of gravel to stone sized coarse fragments are contained within the matrix. As the till is derived from Precambrian bedrock, its reaction is neutral to moderately acidic.

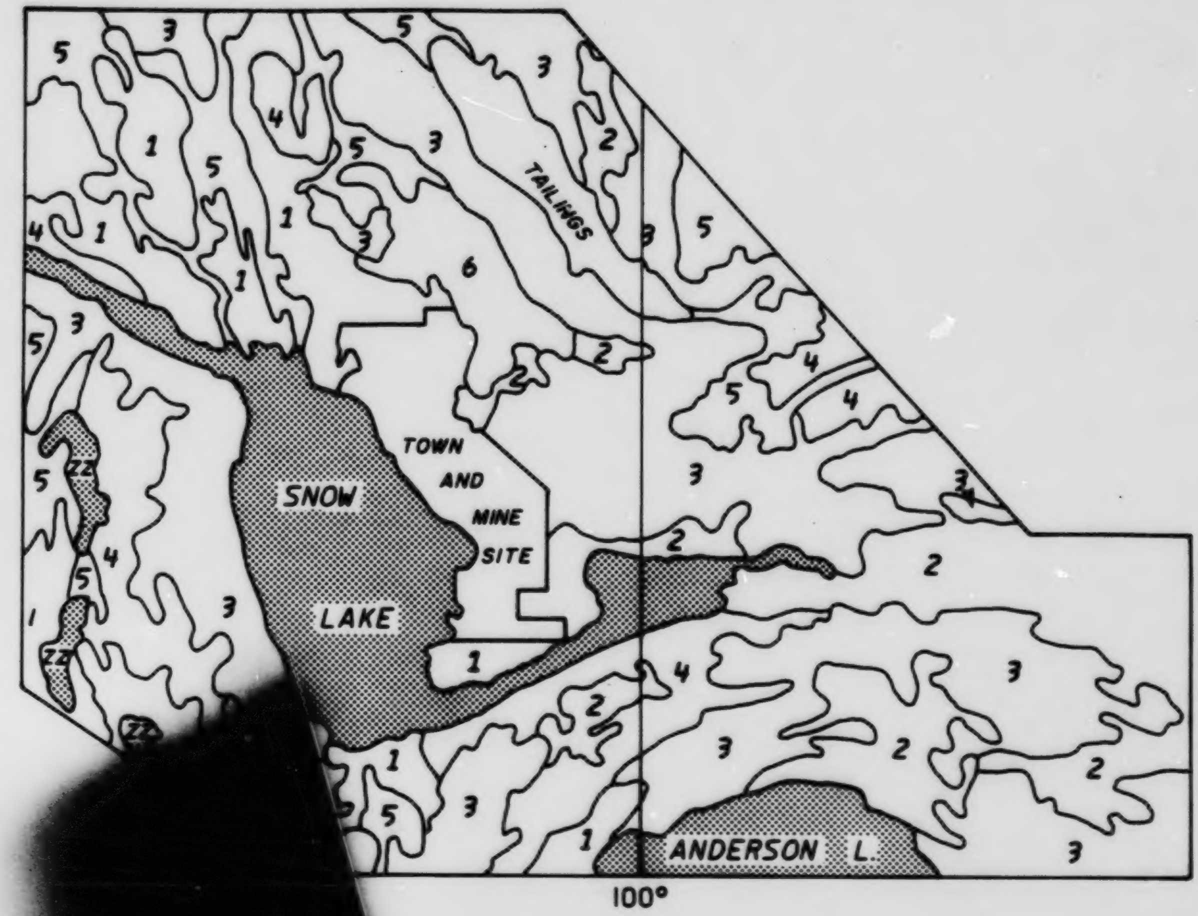
Glaciofluvial deposits. Limited areas of glacio-fluvial sand and mixtures of sand and gravel are scattered throughout the area, but no eskers, kames or extensive outwash areas are present. Because the glaciofluvial deposits have been derived from the Precambrian till, the reaction of these deposits ranges from neutral to moderately acidic.

Lacustrine deposits. After retreat of the glacier ice, the area was inundated by waters of Glacial Lake Agassiz. All land within the survey area likely was inundated but not all areas were affected to the same extent.



DIVISION	***SECTION***	***SUBSECTION***
B Kazan Upland	B1 Grassland - Burntwood River Plain	.1 Snow Lake Plain
		.2 Three Point Lake Plain
	B2 Churchill River Plain	.2 Southern Indian Lake Plain
D Manitoba Plain	D4 Ceder Lake Plain	.1 Moose Lake Plain .2 The Pas Moraine
	D5 Suggi Lake Plain	.1 Namew Lake Plain
Lowlands	D7 Minago Lowland	.1 Hargrave Lowland

Figure 2. Physiography



1	[illegible] lacustrine ; minor shallow organic.
2	[illegible] lacustrine and shallow to deep organic.
3	[illegible]dium textured till , residual and and colluvial and [illegible]d deep organic.
4	Major bed[illegible]rse to medium textured till ; minor shallow and deep org[illegible]
5	Major deep and shallow organic.
6	Major flooding ; minor fine textured lacustrine and organic.

Figure 3. Surface Deposits

During high water levels of the lake, clay to loam textured sediments were deposited in deep water areas. During low water level stages of Lake Agassiz, some of the terrain was affected by wave action. This process eroded and washed till deposits, modified the lacustrine sediments and redeposited materials. However, former beaches or strand lines have not been encountered, although some cobbly areas possibly could mark former shorelines.

The glacial lake sediments consist largely of moderately to strongly calcareous clay, loam and silt. Most of these deposits are free of coarse fragments, but in areas bordering till outcroppings and in areas where wave action has redistributed previously deposited materials, small to moderate quantities of cobbles and boulders may be found incorporated into the lacustrine sediments. Most lacustrine deposits occur as pockets and blankets of limited extent; however, exten[illegible] are located in the northwest section of the survey area.

Lacustrine sediments also occur extensively underneath peatlands. In a few areas a thin lacustrine covering overlies glacial till material.

Alluvial deposits. Areas of alluvial deposits are small. These sediments have been and are being deposited along river and creek courses.

Organic deposits. After recession of Glacial Lake Agassiz, peat development commenced in low lying areas and shallow waterbodies. A significant acreage of the survey area is covered by peat. The peat materials are generally moderately well decomposed with a slightly decomposed (fibric) surface peat. Most of the organic deposits are a layered mixture of peats formed in fen, swamp and bog environments. Woody fragments derived from woody shrubs like alder and willow and from black spruce and tamarack trees commonly are present in the peat. Most peatlands in the area seem to have started as fens and later on evolved into treed fens, swamps or bogs.

Some permafrost is present in most of the large peatlands. The permafrost is largely confined to slightly elevated peat plateau remnants. Old collapse scars and the presence of small pools in permafrost areas may indicate a decline in permafrost distribution. Although in some areas the permafrost extends to several meters depth, most of the permafrost encountered in the area is thin.

1.4 Relief and Drainage

The princiapl relief and drainage features of the Snow Lake survey area are shown in Figure 4.

Elevations within the project area vary from more than 305 meters (1000 feet) for the highest bedrock outcrops to approximately 235 meters (775 feet) at some lake levels. The topography of the area varies from level in peatlands to gently or moderately undulating in areas of lacustrine deposits to strongly broken, hilly and rolling in bedrock areas.

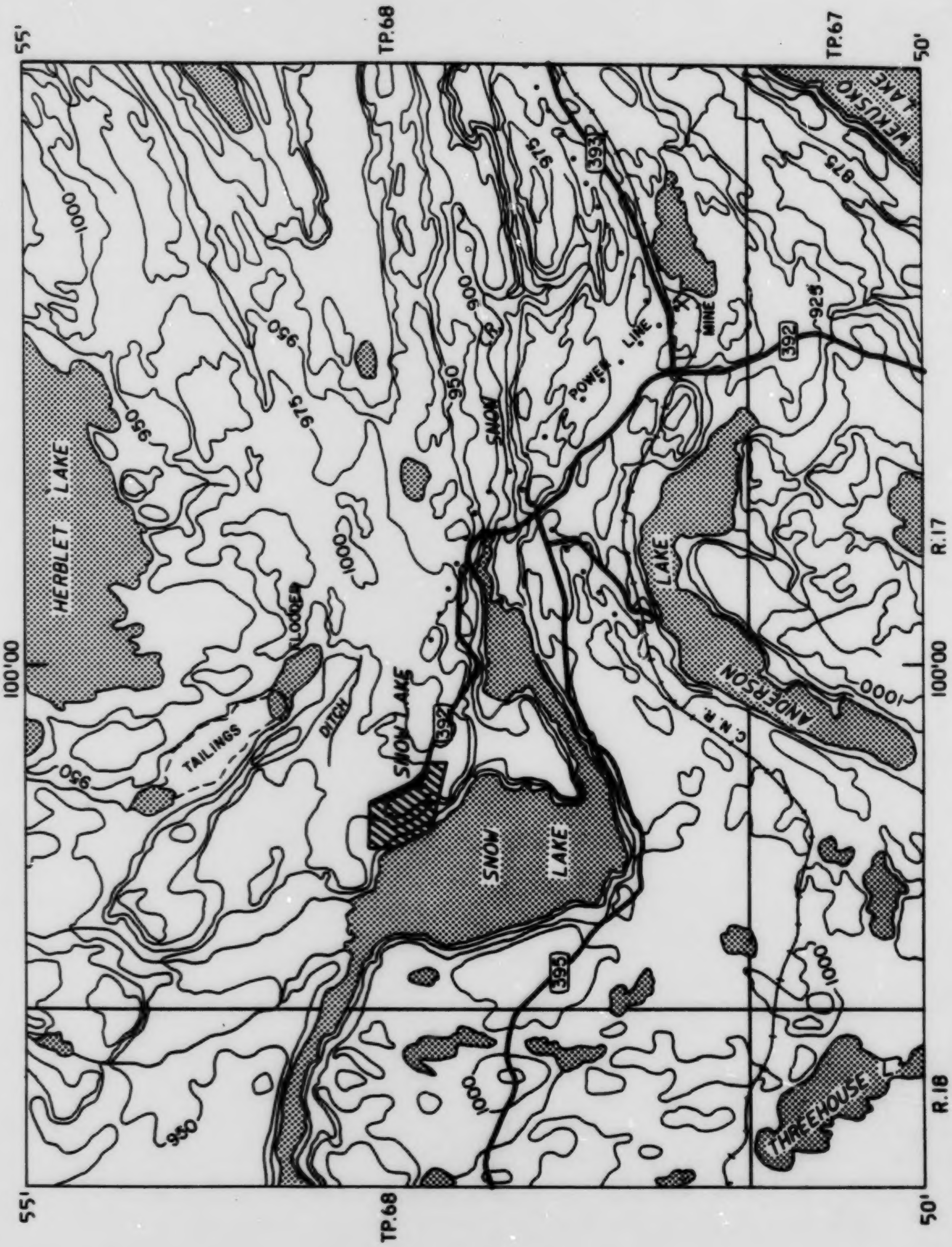


Figure 4. Principal Relief and Drainage

The generally broken topography creates a large number of highs and lows resulting in strongly varying drainage conditions within relatively short distances. Runoff from bedrock and other upland areas collects in peat filled lows, which slowly release excess water to creeks and lakes. Groundwater tables are high in most peatlands and in low areas bordering the peatlands. The free water table often is at or near the surface during spring and early summer, but drops to between 20 and 50 cm depth later in the year. The retarded release of runoff waters reduces peak flows in some creeks and ensures at the same time a more enduring flow.

Bedrock areas and associated till uplands are generally well drained. Areas with lacustrine deposits are moderately well to imperfectly and poorly drained depending on local relief. Mineral uplands generally lack a free water table within 150 cm of the surface, but occasionally bedrock lows, infilled with glacio-fluvial or till materials, have water tables within 100 cm depth.

Most of the survey area drains through a number of creeks into Snow Lake, but part of the north-eastern section drains into Herblet Lake, while part of the southern section drains into Anderson Lake. Snow, Anderson and Herblet Lakes in turn drain into Wekusko Lake, which is part of the Grass River drainage system (Figure 4).

In some areas drainage has been improved through ditching, while in other areas road construction, pipelines and embankments have impeded natural drainage resulting in localized flooding.

1.7 Climate

No meteorological station is located within the study area, but data from the station at Flin Flon has some relevance to the study area. Temperature and precipitation data from this station are presented in Table 1.

The survey area is situated within subregion 1 of the High Boreal, subhumid Ecoclimatic Region (Manitoba Ecoclimatic Regions Working Group, 1985) (Fig. 5). This region is characterized by long, cold winters and short, cool summers. The mean annual air temperature (MAAT) is -1.9°C and the mean annual precipitation is 485 mm. The mean freeze-free period is 93 days, but varies significantly, as does the number of degree days which averages 1089.

The soil climate of the area is classified as cold Cryoboreal climate with humid and aquic soil moisture regimes (Clayton et al, 1977). According to soil climate data collected by the Soil Survey in this area, mean annual soil temperature (MAST) at 50 cm depth is between 2.1 and 3.7°C on well drained clay, approximately 2.8°C on poorly drained clay and about 3.7°C on well drained loamy sand and sandy loam. The mean summer soil temperature (MSST) at 50 cm is respectively between 5.7 and 8.9°C, about 5.2°C and between 9.2 and 10.5°C. Organic soils have colder thermal regimes than mineral soils in the same area and at 50 cm depth these soils have MAST of less than 2°C and MSST of less than 5°C.

Table 1. Climatic Data for Flin Flon[1] (elevation 335 m.a.s.l.)

Mean Annual Rainfall (mm)[2]	332.5
Mean Annual Snowfall (cm)[2]	140.5
Mean Total Precipitation (mm)[2]	475.8
Average Precipitation May 1 - Sept. 30 (mm)[2]	305.4
Mean Daily Temperature (°C)[3]	-0.3
Average Date Last Spring Frost (0°C)[3]	May 22
Average Date First Fall Frost (0°C)[3]	Sept. 19
Frost Free Period (>0°C)[3]	119
Growing Degree Days (above 5°C)[2]	1425.7

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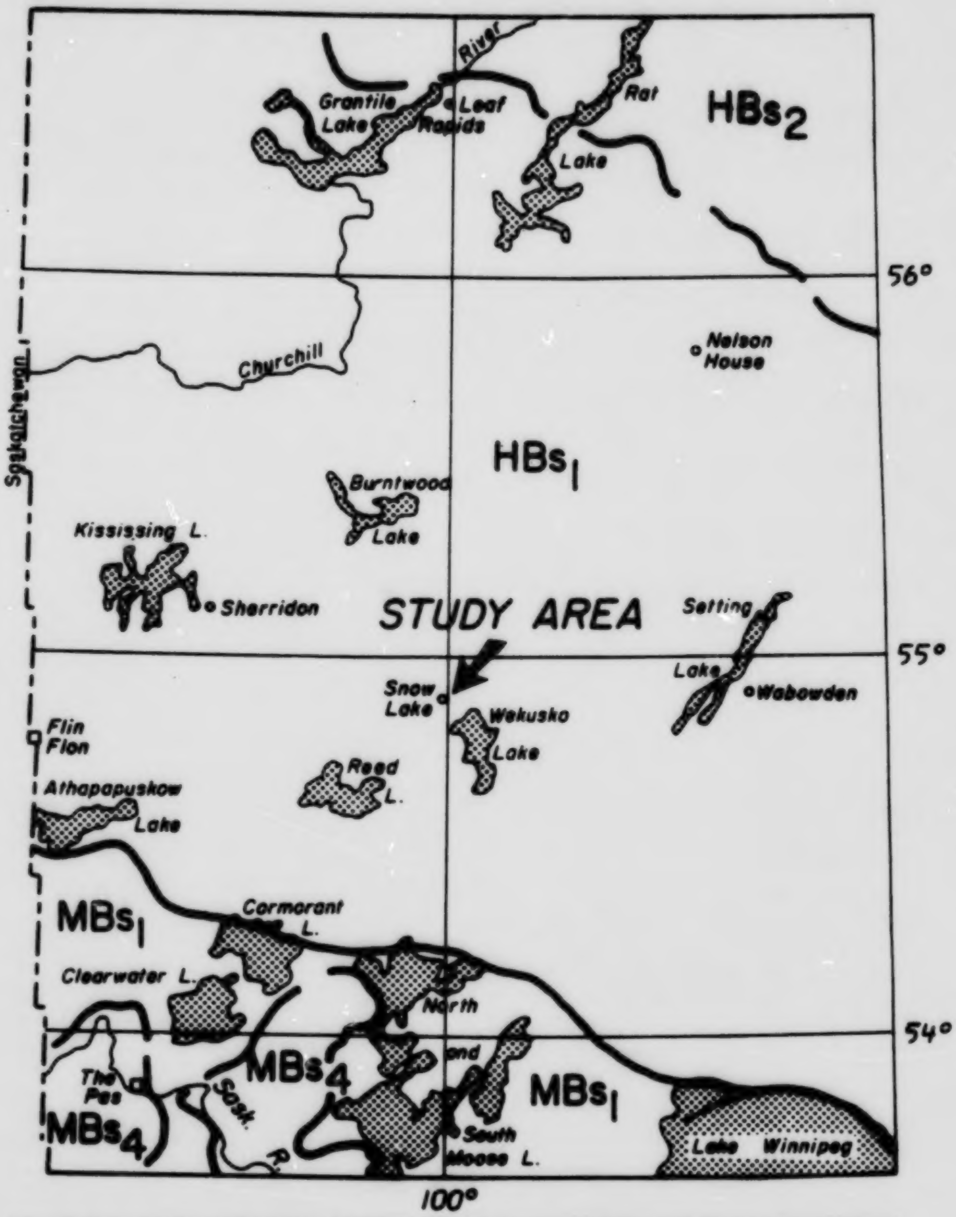
[1] Canadian Climatic Normals 1951-1980. Vol. 2 Temperature, Vol. 3 Precipitation, Vol. 4, Degree Days, Vol. 6 Frost. Atmospheric Environment Service, 1982.

[2] Based on 25 to 29 years of records.

[3] Based on 30 years of records; adjusted normals based on 5 to 19 years, inclusive, from 1951-1980 and any other available data from 1931-1950.



ECOPROVINCE	ECOCLIMATE REGION NAME	SYMBOL	SUBREGION
Boreal	Mid Boreal, subhumid	MBs	1 4
	High Boreal, subhumid	HBs	1 2

——— Region Boundary

— — Subregion Boundary

Figure 5. Eco-Climatic Regions

The soil moisture regimes are dominantly humid and subhumid on clay and subhumid on sandy loam and loamy sand. Organic soils are aquic and peraquic. Soil water deficits occur on freely drained clayey, loamy and sandy soils but deficits are largest on the coarser textured soils. Soils that are saturated for moderately long periods occur extensively and consist largely of poorly drained clayey and organic soils.

1.7 Vegetation

The study area straddles the boundary between the Nelson River Section (B21) and the Northern Coniferous Section of the Boreal Forest Region (Rowe, 1972), but its vegetative characteristics are largely those of the Nelson River Section. The dominant tree species in the area is black spruce (Picea mariana). However, due to variations in moisture regime, soil texture and soil depth, exposure, fire history and other environmental factors, the vegetation varies significantly from one locality to the next.

To provide a more detailed picture of the vegetation of the area the vegetation is described in relation to the major surficial deposits found in the area.

Bedrock outcrops have generally, if present, a forest cover dominated by jack pine (Pinus banksiana). This is due to fire history and the widespread occurrence of shallow, coarse textured soils with low water holding capacity. However if the incidence of fire is reduced black spruce may become an important vegetation component in bedrock areas, especially where deposits are deeper or in depressions.

The steeply sloping strip of land along the south and west sides of Snow Lake has a forest cover different from that in other bedrock dominated areas. Possibly due to a long fire-free period, deep L-H layers cover most of the slopes. The organic layers plus in situ weathered bedrock and colluviated materials that fill cracks and hollows, provide a much better rooting medium for trees than found in bedrock areas which have been burnt frequently. The tree cover in this area is old and consists of large white spruce (Picea glauca), black spruce, balsam fir (Abies balsamea) and some jack pine. The shrub layer is missing in most areas, while the groundcover consists of feather mosses with some herbs.

Till areas support mixed stands of jack pine, black spruce, trembling aspen (Populus tremuloides) and some white birch (Betula papyrifera) and white spruce. Understory vegetation, when present, is usually speckled alder (Alnus rugosa). Groundcover vegetation is mostly ericaceous shrubs like bearberry (Arctostaphylos uva-ursi) and rock cranberry (Vaccinium vitis-idaea), rose (Rosa acicularis), herbs and extensive to patchy growth of feathermosses and lichens.

Lacustrine clay areas support a forest cover dominated by black spruce mixed with jack pine and trembling aspen. Some white spruce may be present, especially in areas close to Snow Lake. Understory shrubs, if present, are alder and willow (Salix spp.). Low shrub vegetation consists of ericaceous shrubs, like Labrador tea (Ledum groenlandicum) on moist sites and rock cranberry and twinflower (Linnaea borealis) on nearly all sites. The moss cover is often extensive and is dominated by Schreber's moss (Pleurozium schreberi), plume moss (Hypnum crista-castrensis) and Hylocomnium splendens and local patches of Sphagnum mosses in moist localities. Poorly drained clay areas have a black spruce tree cover with a, at times, dense alder and willow shrub layer. Labrador tea and other ericaceous shrubs are common, while Sphagnum and feathermosses may form a continuous groundcover.

Organic deposits support a number of markedly different vegetation types. The very poorly drained fen peatlands have a vegetation dominated by sedges (Carex spp.). Other vegetation present includes stunted black spruce and tamarack (Larix laricina), swamp birch (Betula glandulosa), willow and alder. Brown mosses (Depranocladus and Tomenthypnum spp.), Mnium and Sphagnum mosses may be prominent locally. Herbs and forbs like bog bean (Menyanthes trifoliata) are locally significant as well. The poorly drained, slightly elevated peatlands are generally forested with black spruce or black spruce and tamarack. The low shrub layer of Labrador tea, leather leaf (Chamaedaphne calyculata), bog laurel (Kalmia polifolia) and bog-rosemary (Andromeda glaucophylla) may be extensive. Herbs and forbs include threeleaf smilacina (Smilacina trifolia) and some sedges. Moss cover is Sphagnum and feathermosses. The elevated, permanently frozen peatlands have dominantly a black spruce-feathermoss or black spruce-Sphagnum moss vegetation with local areas of Labrador tea.

PART 2

METHODOLOGY

2.1 Mapping

The survey area was mapped at a scale of 1:20 000 by examining soils along foot traverses. Sites were selected on the basis of pre-survey interpretation of pattern and tone of 1:16 000 (4" = 1 mile) scale, black and white, panchromatic aerial photographs. Traverses were planned by linking a number of sites in such a way that maximal information on the area would be obtained from investigation of the sites and observation of the intervening terrain. Due to the lay of the land and orientation of lakes and streams, some areas were not investigated. The mapping of these areas has been accomplished solely by interpretation of aerial photographs and extrapolation of data.

About 200 soils and sites were fully described and 11 soils were investigated in detail and sampled for laboratory analyses. Mineral soils generally were examined to a depth of 80-120 cm, except where stones, bedrock or high water table precluded probing to those depths. Non-frozen organic soils were probed and examined to a depth of about 20 cm into the underlying mineral material or, in the case of deep organic deposits, to a total depth of 200 cm or more.

2.2 Map Units

A map unit represents mappable portions of the soil landscape that together have characteristics and properties varying within more or less narrow limits that are determined by the intensity of the survey. A map unit contains predominantly one or more than one soil or nonsoil individual plus a certain proportion (varying within prescribed limits) of unnamed and undescribed inclusions. They are delineated on the basis of the types and relative proportions of their soils or nonsoils, as well as on the basis of external criteria such as slope, stoniness or erosion.

Soil maps show the distribution of kinds of soil and, as such, serve as a link so that the knowledge gained in one locality about the usefulness or behavior of a kind of soil can be extended to other bodies of the same soil.

A map unit is named from its principal component soils or non-soils. It is described in terms of the properties of these components, their relative proportions and other external land attributes. In this project, units are described in terms of named soil series, phases of soil series and soil complexes (mostly organic soils and areas with a high bedrock component).

Map units will always contain some small inclusions. These inclusions may be soil or nonsoil mapping individuals that are named and have their own map units elsewhere in the survey, or they may be rare or insignificant soils or nonsoils that are not recognized and not named at all in the survey. They may, however, be mentioned in the description of soil types in the report.

2.3 Simple and Compound Map Units

There are two major types of map units: simple and compound. The difference between them is defined in terms of the proportion and contrast of their components.

A Simple Map unit contains predominantly one soil or nonsoil such as bedrock outcropping. The proportion of its components vary from those that are comprised of at least 65 percent of the predominant type with the remaining 35 percent consisting of similar but nonlimiting components, to at least 85 percent of the predominant type with the balance comprised of components which may be strongly contrasting or limiting.

A Compound Map Unit contains predominantly two soils or nonsoils (or a combination of the two). The proportion of one of the major components may be considerably larger than the other or they may be about equal. If the components are similar and nonlimiting, no single component represents more than 65 percent, or if they are dissimilar and more limiting, no single component represents more than 75 percent, or if dissimilar and limiting, no single component represents more than 85 percent. Components of mapping units are considered dominant if they occupy over 40 percent of the unit, significant from 15 to 40 percent, and minor if they occupy less than 15 percent. Minor components are described only if they are highly contrasting.

Compound units are employed in mapping complex soil landscapes where dissimilar soils occur in very intricate patterns and in such small segments that it is not practical to delineate them separately on the map.

Very often, it is desirable to indicate by map unit symbol, minor variations in certain intrinsic properties of soils or landscape features that deviate from the normal. These variants or phases of series usually affect soil management. In this survey area the effect of two such properties and features are indicated. These are slope class and degree of stoniness. The degree or magnitude of each is designated in the following manner:

Slope Class

x - 0 to 2% level to nearly level
c - 2 to 5% very gently sloping
d - 5 to 9% gently sloping
e - 9 to 15% moderately sloping
f - 15 to 30% strongly sloping
g - 30 to 45% very strongly sloping
h - 45 to 70% extremely sloping
i - 70 to 100% steeply sloping
j - >100% very steeply sloping

Stoniness

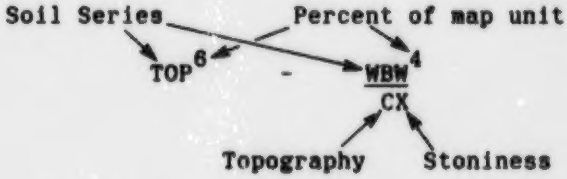
x - non stony
1 - slightly stony
2 - moderately stony
3 - very stony
4 - exceedingly stony
5 - excessively stony

The convention employed to indicate these features in the map symbol is as follows:

If none of the above properties are observed to be significant, the map symbol representing the normal or unaffected soil series is used alone without modifiers.

If one or more phase features are recognized, the appropriate letter or number is placed below the soil series symbol in one of two designated locations in the map unit symbol. The designated order is slope class and stoniness. If a particular feature is not observed to be significant, an x is used in its appropriate designated location in the map symbol.

For example, the compound map unit coded:



is interpreted to mean that 60 percent of the mapping unit consists of Thompson Lake (TOP 6) series having no or minimal phase features; and 40 percent Wabowden (WBW 4) series having very gently sloping (c) topography; minimal or no stoniness. Definitions of topography and stoniness classes are given in the Glossary.

2.4 Sampling

During the course of field investigations and mapping, soil samples were taken at selected locations for soil characterization. Several soil sites were described in detail and sampled for chemical and physical analysis. Data are presented in the Appendix.

PART 3

DEVELOPMENT, CLASSIFICATION AND MORPHOLOGY OF SOILS

3.1 Soil Development

The principle factors affecting soil formation are climate, vegetation, parent material, relief and drainage. The type of soil formed at any one place is dependent upon the interactions of these factors, the length of time they have been operative and the influence of human activity.

The soils of the study area have developed beneath boreal forest cover and under subarctic climatic conditions with or without permafrost. Under these environmental conditions a low order of chemical weathering and partially mobilized and partially translocated clay, iron and aluminum indicate weak podzolic processes in the mineral soils. Organic soils, generally formed from sedge, shrub and forest litter, feather and Sphagnum moss materials have accumulated extensively under past and present climatic conditions (Tarnocai, 1975).

The dominant soils in the survey area are Dystric Brunisols on well and imperfectly drained tills and Gray Luvisols on well and imperfectly drained clays. Rego Gleysols and Humic Gleysol with and without peaty surfaces, have developed on poorly drained mineral soils. Mesisols are the dominant organic soils developed on organic materials.

3.2 Soil Series and Soil Complex Descriptions

The soil series and complexes mapped in the study area are described in alphabetical order giving generalized morphological descriptions including name, genetic profile, type, texture, parent materials, topography and drainage.

A comprehensive grouping of soils and parent materials is presented in Tables 2 and 3.

Table 3. Parent Materials and Related Soils of the Snow Lake Study Area

		Map Symbol	Area (ha)	% of Map Area
A.	BEDROCK			
1.	Nonsoils and small areas of soils developed on very thin veneers and pockets of sandy till, loamy colluvial and mesic organic deposits.			
	a) Rapidly to well drained Precambrian Bedrock (nonsoil)	ARC	303.4	8.0
B.	LACUSTRINE			
1.	Soils developed on deep (>1 m), weakly to moderately calcareous, clayey (HC, C, CL) deposits.			
	a) Well drained			
	Sipiwesk Series (Orthic Gray Luvisol)	SWK	11.4	0.3
	Wabowden Series (Solonetzic Gray Luvisol)	WBW	320.7	8.4
	b) Imperfectly drained			
	Roe Lake Series (Gleyed Gray Luvisol)	ROK	157.8	4.2
	c) Poorly drained			
	Medard Series (Rego Gleysol)	MDR	56.2	1.5
	Medard Series, peaty phase (Rego Gleysol, peaty phase)	MDRp	53.9	1.4
2.	Soils developed on thin (30 to 75 cm), weakly to moderately calcareous, clayey (HC, C, CL) deposits overlying strongly to very strongly calcareous, fine silty to fine loamy (SiCL, SiL) sediments.			
	a) Well drained			
	Pipun Series (Orthic Gray Luvisol)	PPU	7.7	0.2
3.	Soils developed on deep (>1 m), stratified, weakly to moderately calcareous, clayey (HC, C, CL) and sandy (S, LS, FS) deposits.			
	a) Well drained			
	Burntwood Series (Orthic Gray Luvisol)	BTW	45.4	1.2
4.	Soils developed on shallow (10 to 100 cm), weakly to moderately calcareous, clayey to fine loamy (HC, C, CL, L) deposits.			

Table 2. Soil Series and Complexes of the Snow Lake Study Arranged in Relation to Soil Moisture Class, Subgroup and Par

Soil Moisture Class	Subgroup	Parent Materials			
		Till	Lacustrine		
		Sandy Skeletal (CoS, S, LS) to Coarse Loamy (SL, FSL)	Clayey (HC,C, SiC)	Clayey (HC,C,SiC) over Fine Loamy and Fine Silty (SiL, SiCL)	Stratified Clayey (H C, SiC) and Sandy (FS, S)
Well and Moderately Well	Orthic Gray Luvisol		Sipiwesk(SWK)	Pipun(PPU)	Burntwood(BTW)
	Solonetzic Gray Luvisol		Wabowden(WBW)		
	Orthic Gray Luvisol, lithic phase			Drunken Lake(DRL)	
	Eluviated Dystric Brunisol	Fay Lake(FYK)			
	Eluviated Dystric Brunisol, lithic phase	Wolverton(WVT)			
Imperfectly	Gleyed Gray Luvisol		Roe Lake(ROK)		
	Gleyed Eluviated Dystric Brunisol	Hat Lake(HTK)			
Poor	Rego Gleysol		Medard(MDR)		
	Rego Gleysol, peaty phase		Medard, peaty phase(MDRp)		

		Forest Peat or Thin (0-60 cm) Sphagnum Peat over Forest Peat (mosses, nee			
		Deep (160 cm)	Shallow (40 - 160 cm)		
			over Precambrian bedrock	over clayey lacustrine (C, CL)	over sandy til (S-S,LS,SL)
Imperfect to Poor	Mesic Organic Cryosol*	Nekik Lake(NKL)			
	Fibric Organic Cryosol	Nekik Lake(NKL)			
Poor to Very Poor	Typic Mesisol	Hargrave(HGR)	Flux Lake(FXL)		
	Fibric Mesisol	Hargrave(HGR)	Flux Lake(FXL)		
	Typic Mesisol, sphagnic phase	Hargrave(HGR)	Flux Lake(FXL)		
	Mesic Fibrisol	Hargrave(HGR)	Flux Lake(FXL)		
	Terric Mesisol			Atik (ATK)	File Lake (FLL
	Terric Fibric Mesisol			Atik (ATK)	File Lake (FLL
	Terric Mesisol, sphagnic phase			Atik (ATK)	File Lake (FLL
	Terric Mesic Fibrisol			Atik (ATK)	File Lake (FLL

		Fen Peat (sedges, herbaceous plants, brown mosses, leaves and needles)			Sph
		Deep (160 cm)	Shallow(40 - 160cm)		Dee
			over clayey lacustrine (C, CL)	over sandy lacustrine or glacio-fluvial (LS, S)	
Poor to Very Poor	Typic Mesisol	Rock Island (RLX)			
	Fibric Mesisol	Rock Island (RLX)			
	Typic Fibrisol				Kis
	Mesic Fibrisol				Kis
	Terric Mesisol		Reed Lake (REX)	Waskik Lake (WSK)	
	Terric Fibric Mesisol		Reed Lake (REX)	Waskik Lake (WSK)	
	Terric Mesic Fibrisol		Reed Lake (REX)		

Par Lake Study Arranged in Relation to Soil Moisture Class, Subgroup and Parent Material

	Parent Materials					
	ill	Lacustrine			Outwash	Colluvial, Residual
(H	Skeletal S, LS) to e Loamy FSL)	Clayey (HC,C, SiC)	Clayey (HC,C,SiC) over Fine Loamy and Fine Silty (SiL, SiCL)	Stratified Clayey (HC, C, SiC) and Sandy (FS, S)	Sandy (S, FS)	Coarse Loamy (LFS, FSL, L)
		Sipiwesk(SWK) Wabowden(WBW)	Pipun(PPU)	Burntwood(BTW)		
			Drunken Lake(DRL)			
	ake(FYK) rton(WVT)					Snow Lake(SOW)
		Roe Lake(ROK)				
	ake(HTK)				Pakwa(PKW)	
		Medard(MDR) Medard, peaty phase(MDRp)				

	need Forest Peat or Thin (0-60 cm) Sphagnum Peat over Forest Peat (mosses, needles, leaves, wood)				
	(160 cm)	Shallow (40 - 160 cm)			
til)		over Precambrian bedrock	over clayey lacustrine (C, CL)	over sandy till (S-S,LS,SL)	over sandy glacio-fluvial (LS, S)
	k Lake(NKL)				
	k Lake(NKL)				
	rave(HGR)	Flux Lake(FXL)			
	rave(HGR)	Flux Lake(FXL)			
	rave(HGR)	Flux Lake(FXL)			
	rave(HGR)	Flux Lake(FXL)			
(FLL			Atik (ATK)	File Lake (FLL)	Gormley Lake (GRY)
(FLL			Atik (ATK)	File Lake (FLL)	Gormley Lake (GRY)
(FLL			Atik (ATK)	File Lake (FLL)	Gormlev Lake (GRY)
(FLL			Atik (ATK)	File Lake (FLL)	Gormley Lake (GRY)

	Sph Peat (sedges, herbaceous plants, brown mosses, leaves and needles)			Sphagnum Peat
		Shallow(40 - 160cm)		
Dee	(160 cm)	over clayey lacustrine (C, CL)	over sandy lacustrine or glacio-fluvial (LS, S)	Deep (160 cm)
	Island (RLX)			
	Island (RLX)			
Kis				Kiskitto (KHX)
Kis				Kiskitto (KHX)
		Reed Lake (REX)	Waskik Lake (WSK)	
		Reed Lake (REX)	Waskik Lake (WSK)	
		Reed Lake (REX)		

	Map Symbol	Area (ha)	% of Map Area
a) Well drained Drunken Lake Series (Orthic Gray Luvisol, lithic phase)	DRL	97.7	2.6
C. MORAINAL (TILL)			
1. Soils developed on deep (>1 m), noncalcareous, sandy skeletal (GrS, cobbly S), sandy (S, LS) and coarse loamy (FSL) deposits.			
a) Well drained Fay Lake Series (Eluviated Dystric Brunisol)	FYK	460.1	12.1
b) Imperfectly drained Hat Lake Series (Gleyed Eluviated Dystric Brunisol)	HTK	7.7	0.2
2. Soils developed on shallow (<1 m), noncalcareous, sandy-skeletal (GrS, cobbly S), sandy (S, LS) and coarse loamy (FSL) deposits.			
a) Well drained Wolverton Series (Eluviated Dystric Brunisol, lithic phase)	WVT	173.2	4.6
D. GLACIO-FLUVIAL			
1. Soils developed on deep (>1 m), noncalcareous, sandy (S,FS), stratified deposits.			
a) Imperfectly drained Pakwa Series (Gleyed Eluviated Dystric Brunisol)	PKW	8.2	0.2
E. COLLUVIAL AND RESIDUAL			
1. Soils developed on shallow and very shallow (10-50 cm), noncalcareous, coarse loamy (FSL, L, VFSL, SiL) and fine loamy (L, CL, SiCL, SCL) over Precambrian bedrock.			
a) Well drained Snow Lake Complex (Orthic and Eluviated Dystric Brunisol, lithic phase; Orthic and Eluviated Eutric Brunisol, lithic phase)	SOW	453.6	11.9

	Map Symbol	Area (ha)	% of Map Area
F. FOREST PEAT			
1. Soils developed on deep (>160 cm), mesic forest peat or thin (<60 cm) fibric Sphagnum peat overlying mesic forest peat.			
a) Imperfectly to poorly drained Nekik Lake Complex* (Mesic Organic Cryosol; Fibric Organic Cryosol)	NKL	46.0	1.2
b) Poorly drained Hargrave Complex (Typic Mesisol; Mesic Fibrisol; Fibric Mesisol; Typic Mesisol, sphagnic phase)	HGR	127.3	3.6
2. Soils developed on shallow (40-160 cm), mesic forest peat or thin (<60 cm) fibric sphagnum peat overlying mesic forest peat underlain by:			
1. fine to medium textured, calcareous lacustrine sediments			
a) Poorly drained Atik Complex (Terric Fibric Mesisol; Terric Mesic Fibrisol; Terric Mesisol; Terric Mesisol, sphagnic phase)	ATK	278.2	7.3
2. coarse textured, noncalcareous till			
a) Poorly drained File Lake Complex (Terric Fibric Mesisol; Terric Mesic Fibrisol; Terric Mesisol; Terric Mesisol, sphagnic phase)	FLL	34.1	0.9
3. coarse textured lacustrine or fluvial deposits			
a) Poorly drained Gormley Lake Complex (Terric Fibric Mesisol; Terric Mesic Fibrisol; Terric Mesisol; Terric Mesisol, sphagnic phase)	GRY	3.9	0.1
4. Precambrian bedrock			
a) Poorly drained Flux Lake Complex (Fibric Mesisol, lithic phase; Mesic Fibrisol, lithic phase; Typic Mesisol, lithic phase	FXL	5.1	0.1
G. FEN PEAT			
1. Soils developed on deep (>160 cm), mesic fen (sedge) peat with little or no sphagnum peat.			

	Map Symbol	Area (ha)	% of Map Area
a) Very poorly drained Rock Island Complex (Typic Mesisol; Fibric Mesisol)	RLX	66.5	1.8
2. Soils developed on shallow (40-160 cm), mesic fen (sedge) peat with little or no sphagnum peat underlain by:			
1. fine to medium textured lacustrine sediments			
a) Very poorly drained Reed Lake Complex (Terric Mesisol; Terric Fibric Mesisol; Terric Mesic Fibrisol)	REX	59.4	1.6
2. coarse textured lacustrine or fluvial deposits			
a) Very poorly drained Waskik Lake Complex (Terric Mesisol, Terric Fibric Mesisol)	WSK	4.4	0.1
H. SPHAGNUM PEAT			
1. Soils developed on thick (>90 cm) fibric sphagnum peat underlain by significant layer(s) of mesic forest peat, or deep (>160 cm) fibric and mesic sphagnum peat.			
a) Poorly drained Kiskitto Complex (Mesic Fibrisol; Typic Fibrisol)	KHX	51.7	1.4

* The control section of permanently frozen soils is 100 cm; therefore, Nekik Lake soils have developed on greater than 100 cm of mesic forest peat.

Acidic Bedrock Complex - ARC

The Acidic Bedrock complex consists of rapid to excessively drained bedrock outcrops. The bedrock is largely composed of partly metamorphosed volcanic bedrock, mafic rock and gneisses. The bedrock occurs as hills and knobs which are often steep sided, although in some areas the bedrock is more subdued and has gentle, rounded slopes.

Little soil material is found on steep sided and pronounced bedrock outcrops. Coarse fragments and mineral soil debris occur mostly in small depressions and cracks. Vegetation is largely confined to these pockets of unconsolidated materials and consists of jack pine and black spruce clumps with a ground cover dominantly of grasses, juniper, ericaceous shrubs and mosses. Extensive areas of bedrock are colonized by various types of lichens.

Associated soils are Wolverton and Hat Lake series. Minor or isolated outcrops of bedrock often form part of Wolverton, Hat Lake and Snow Lake map unit delineations.

Atik Complex - ATK

The Atik complex consists of poorly to very poorly drained Terric Mesisol soils developed on shallow (40 to 160 cm) mesic forest peat. A thin (15 to 60 cm) fibric Sphagnum peat layer may be present in the form of a hummocky, but usually discontinuous, surface mat. The organic materials are underlain by moderately to strongly calcareous, medium to fine textured lacustrine sediments. The Atik soils occur in level to depressional areas and generally have high water tables throughout the year. In the survey area, the vegetation on these soils reflects conditions (pH, nutrient levels) that are indicative of a more nutritionally rich environment than that usually found in bogs. The tree layer is dominated by tamarack and black spruce. The shrub layer often contains alder and willow, while the groundcover consists largely of mosses and herbs.

The Atik complex soils are dominantly Terric Fibric Mesisols and Terric Mesisols. Associated soils are those belonging to the Nekik Lake, Reed Lake and Hargrave complexes. Medard series soils are present along the margins of the Atik units, where peat deposits are thinner.

In a representative profile of an Atik soil the solum consists of layers of slightly woody, moderately to slightly decomposed forest and sphagnum peat to a depth of 80-120 cm. The organic materials overlie calcareous clay loam textured lacustrine sediments. The soil is poorly drained with the water table at 80 cm depth.

The vegetation consists of a black spruce tree layer with a Labrador tea and rock cranberry dominated low shrub layer. Baked appleberry, feathermosses and some lichens form the ground cover. The physical, chemical and morphological properties of an Atik soil from the survey area are presented in Appendix A.

Burntwood Complex - BTW

The Burntwood complex consists of well to imperfectly drained Gray

Luvisol soils, developed on calcareous, non to moderately stony, stratified clayey to sandy glaciolacustrine and/or fluvial deposits. These soils often have a cobbly surface.

The topography of Burntwood soil areas varies from gently sloping blankets to steeply sloping terraces. Permeability is moderate to moderately rapid and largely depends on depth to and extent of clay layers in the solum, which tend to reduce permeability. Surface runoff is slow in the growing season but is significant and rapid during spring snow melt when the soil is still frozen.

The vegetation varies with drainage but often consists of jack pine and black spruce stands mixed with trembling aspen. The ground cover is largely low ericaceous shrubs and feathermosses.

Because of the variability of the Burntwood soil materials, soil profile development varies from Orthic Gray Luvisols to Eutric Brunisols. Some Burntwood soils resemble Sipiwesk soils with a sand cap, while others resemble Pipun soils with a sandy subsoil.

The Burntwood soils occupy only a small acreage and are associated with Sipiwesk, Roe Lake and Pipun soils.

Drunken Lake Series - DRL

The Drunken Lake series consists of well to moderately well drained Orthic Gray Luvisol, lithic phase soils developed on a mantle (30 to 75 cm) of moderately to strongly calcareous, clayey lacustrine sediments overlying very strongly calcareous, fine silty and fine loamy lacustrine deposits overlying Precambrian bedrock. These soils occur in lower, middle and crest positions of gently to moderately sloping, undulating to hummocky landscapes. They have moderately slow permeability, slow surface runoff and a low water table during the growing season. Drunken Lake soils are non-eroded, non to moderately stony and non-saline. They have moderate available water holding capacity and low organic matter content. Native vegetation includes mixed stands of black spruce, jack pine, trembling aspen with alder shrub in the understory. Ground cover is largely feathermosses with low ericaceous shrubs. The majority of these soils are currently under forest cover.

In a representative profile of Drunken Lake soil the solum is approximately 50 cm thick. The profile is characterized by a medium acidic, moderately decomposed LFH horizon, 6 to 10 cm thick; a very strongly acidic, clay loam Ae horizon, 5 to 8 cm thick; a very strongly acidic, clay Btnj horizon, 15 to 25 cm thick, with columnar structure; a strongly acidic, clay Bt horizon 10 to 15 cm thick; and a moderately calcareous, light gray, clay loam Ck horizon. 10 to 20 cm thick over bedrock. The parent material is typically clay loam to fine sandy loam close to the bedrock contact. A typical profile also contains some gravel and cobbles.

Drunken Lake soils occur in close association with bedrock and Wabowden, Sipiwesk and Roe Lake soils. Drunken Lake soils in the study area are often similar to Wabowden soils by having strongly developed, columnar B horizons but differ in having a thin loamy subsoil layer and bedrock contact within 100 cm from the surface.

An example profile of a Drunken Lake soil is presented in Appendix A.

File Lake Complex - FLL

The File Lake complex consists of poorly to very poorly drained Terric Mesisol and Terric Fibrisol soils developed on shallow (40 to 160 cm), stratified, woody, mesic and fibric forest peat or thin (0 to 60 cm) fibric sphagnum peat overlying mesic forest peat. The organic materials are underlain by non-calcareous loamy to sandy till, which often contains significant amounts of coarse fragments especially at the organic-mineral interface. The File Lake soils occur on gently sloping to level and depressional terrain. The water table is high during the growing season and runoff is very slow. Native vegetation varies with depth of peat, depth to groundwater and distance to the mineral upland. Black spruce and tamarack growth is generally stunted. Alder growth may be thick in the peatland margins. Groundcover vegetation is variable and consists mostly of sphagnum mosses and ericaceous shrubs on raised peatlands; feather and patchy sphagnum mosses, herbs and sedges occur in the nutritionally more enriched peatlands.

The File Lake complex includes Terric Fibric Mesisol, Terric Mesic Fibrisol, Terric Mesisol and Terric Mesisol, sphagnic phase soils of which the Terric Fibric Mesisol is the most common.

The Terric Fibric Mesisol soil is characterized by a very strongly acidic, yellowish red fibric sphagnum peat, Of horizon, 15 to 30 cm thick; a strongly acidic, dark reddish brown mesic peat comprised of mixed moss, leaves and needles Om horizon, 40 to 60 cm thick, with slightly hard, woody fragments; a slightly acidic, black, humic Oh horizon, 10 to 15 cm thick; and a slightly acidic, sandy loam 2Cg horizon with cobbles.

An example profile of a shallow File Lake soil is presented in Appendix A.

Flux Lake Complex - FXL

The Flux Lake complex consists of poorly to very poorly drained Mesisol, lithic phase and Fibrisol, lithic phase soils developed on shallow (40 to 160 cm), stratified, woody, mesic and fibric forest peat or thin (15 to 60 cm) fibric sphagnum peat overlying mesic forest peat. The organic materials are underlain by Precambrian bedrock or very thin till veneers over Precambrian bedrock. The Flux Lake soils occur in depressions and on lower positions of gently sloping bedrock terrain. The water table is high during the growing season, and surface runoff is very slow. The vegetation consists of patchy black spruce and tamarack, alder shrub and a groundcover of sphagnum and feathermosses, herbs, ericaceous shrubs and some sedge.

The Flux Lake complex includes Fibric Mesisol, lithic phase, Mesic Fibrisol, lithic phase and Typic Mesisol, lithic phase soils. These soils resemble the File Lake soils in most aspects and are often associated with these soils.

Fay Lake Series - FYK

The Fay Lake series consists of well drained Eluviated Dystric Brunisol soils developed on deep (>100 cm), noncalcareous, sandy loam to loamy sand, morainal (till) deposits. These soils occur in mid, upper and crest positions of gently to steeply sloping blankets and pockets of undulating and hummocky, bedrock controlled, landscapes. They have rapid permeability, slow surface runoff and a deep water table during the growing season. Fay Lake soils are non-eroded, moderately to exceedingly stony and non-saline. They have low available water holding capacity, low organic matter content. Native vegetation includes black spruce, jack pine and trembling aspen stands with some white birch. Alder is common as shrub component while the ground cover is dominated by feathermosses, lichens, herbs and low ericaceous shrubs. The majority of these soils are currently under forest cover.

A representative profile of Fay Lake soil is approximately 60 cm deep. The profile is characterized by a very strongly acidic, dark reddish brown, moss and forest debris LFH horizon, 4 to 8 cm thick; an extremely acidic, grayish brown, loamy sand Ae horizon, 3 to 6 cm thick; a very strongly acidic dark yellowish brown, fine sandy loam Bm horizon, 25 to 35 cm thick; a very strongly acidic, yellowish brown, loamy coarse sand BC horizon, 25 to 50 cm thick; and a very strongly acidic, light yellowish brown loamy sand C horizon. The parent material is typically cobbly. These soils occur in close association with Hat Lake and Wolverton soils.

An example profile of a Fay Lake soil is presented in Appendix A.

Gormley Lake Complex (GRY)

The Gormley Lake complex consists of poorly to very poorly drained organic Terric Fibric Mesisol, Terric Mesic Fibrisol and Terric Mesisol soils developed on shallow (40 to 160 cm) mesic forest peat or thin (0 to 60 cm) fibric sphagnum peat overlying mesic forest peat. The organic materials are underlain by non-calcareous sandy deposits. The Gormley Lake soils occur in flat bogs, basin bogs, peat margin swamps and basin swamps on level to depressional areas in the landscape. These soils have a high water table through most of the year and commonly at the surface during spring melt. Natural fertility of Gormley Lake soils is low. The native vegetation of the Gormley Lake soils consists of stunted black spruce and tamarack trees on raised peatlands to moderately well grown, but patchy black spruce and tamarack in nutritionally rich swamps. The alder understory is prevalent in swamps but lacking on raised bogs. Groundcover varies as well, with ericaceous shrubs like Labrador tea, cranberry and rock-cranberry dominant in the bogs and herbs and sedges common in swamps. Sphagnum mosses are widespread in the bogs, while feathermosses and Mnium species are common in the swamps.

A representative profile of a Terric Fibric Mesisol is approximately 100 cm thick. The profile is characterized by a slightly decomposed, very strongly acidic, sphagnum moss Of horizon, 20 to 30 cm thick; a stratified, moderately to well decomposed peat of mixed moss, herbs, forest leaves or shrubs, woody, strongly acidic Om1 horizon, 50 to 80 cm thick; a well decomposed, herb and sedge peat, strongly to medium acid, Om2 horizon, 20 to 30 cm thick; over neutral sandy or cobbly sandy glacio-fluvial or lacustrine deposits.

These soils occur in close association with bedrock outcrops, Hargrave Complex soils and Flux Lake Complex soils.

Hargrave Complex - HGX

The Hargrave complex consists of poorly to very poorly drained organic soils developed on deep (over 160 cm), woody, stratified, mesic and fibric forest peat. A thin (0 to 60 cm) Sphagnum peat surface layer may be present. These soils are generally found on flat and blanket bogs. Topography is generally level to slightly depressional but can be gently sloping in blanket bog areas. Vegetation is dominated by black spruce, ericaceous shrubs, feather and Sphagnum mosses.

The Hargrave soils are dominantly Typic Mesisol, Fibric Mesisol and Mesic Fibrisol soils of which the Typic Mesisol is most representative.

The Hargrave soils in the study area have been mapped to include forest peat soils developed under nutritionally rich swamp conditions. Generally, the peat is more decomposed, contains less Sphagnum remnants and contains more woody fragments. Vegetative growth, especially tree growth, is better and understory and ground vegetation is more diversified than that on less fertile, raised bogs. In many aspects, these soils resemble Atik Complex soils but are deeper.

The Hargrave soils in the survey area are characterized by a thin, non to slightly decomposed Sphagnum layer (Of). This layer overlies moderately decomposed peat (Om) derived from Sphagnum and feather mosses as well as remains from trees, shrubs and herbs. Below 60 to 100 cm depth the peat is dominantly derived from mosses other than Sphagnum. Herb and woody plant materials increase with depth; at 100 to 200 cm depth the peat is largely derived from woody and herb/sedge vegetation communities and is generally moderately to well decomposed.

Hat Lake Series - HTK

The Hat Lake series consists of Gleyed Eluviated Dystric Brunisol soils developed on deep (>100 cm), moderately acidic to neutral, coarse loamy to sandy, morainal (till) deposits. These soils occur on lower slope positions of gently to moderately sloping blanket landscapes and filled-in hollows on bedrock terrain. These soils have rapid to moderate permeability, very slow surface runoff and a low water table during the growing season. Hat Lake soils are non-eroded, slightly to very stony, and non-saline. They have low water holding capacity and low organic matter content. Native vegetation includes black spruce, trembling aspen and jack pine stands with alder shrub in the understory and a ground cover of feather mosses, ericaceous shrubs like blueberry, rock-cranberry and twinflower, and herbs like bunchberry. The majority of these soils are currently under forest cover.

A representative profile of Hat Lake soil is approximately 35 cm thick. The profile is characterized by a very strongly acidic, slightly to moderately decomposed, leaves, moss and needles, LFH horizon, 6 to 8 cm thick; a very strongly acidic, loamy sand Ae horizon, 5 to 7 cm thick, with coarse fragments; a very strongly acidic, sandy loam or loamy sand Bm horizon, 15 to 25 cm thick, with coarse fragments; a strongly acidic, loamy sand BC horizon, 10 to 20 cm thick, with coarse fragments and a strongly acidic, loamy sand Cgj horizon, with faint mottles.

Hat Lake soils occur in close association with Wolverton and Fay Lake soils.

Kiskitto Complex - KKX

The Kiskitto complex consists dominantly of poorly to very poorly drained Fibrisol soils developed on deep (>160 cm), strongly acidic, fibric and mesic, sphagnum peat over mesic forest or fen peat. The underlying mineral materials are undifferentiated, but are usually strongly gleyed, moderately to strongly calcareous, loamy to clayey, lacustrine sediments. These soils occur on flat bogs, basin bogs and domed bogs on flat or depressional areas in the landscape. Surface runoff is ponded to very slow but subsurface drainage is moderately fast due to moderate to high permeability of the sphagnum and moderately decomposed forest peat materials. The water table is high early in the growing season, but is drawn down to a depth of between 50 and 80 cm by the end of summer. Native vegetation consists of stunted black spruce and tamarack, an ericaceous shrub layer and a ground cover dominated by sphagnum mosses. The majority of these soils are currently in their native state.

The Kiskitto complex includes Mesic Fibrisol, Typic Fibrisol, Fibric Mesisol and Typic Mesisol soils. The Mesic Fibrisol is characterized by an extremely acidic, non-decomposed, fibric sphagnum peat Of horizon, 15 to 30 cm thick; a very strongly acidic, slightly decomposed, fibric sphagnum peat Of horizon, 60 to 80 cm thick; a strongly acidic, moderately decomposed, [illegible] or sedge peat Om horizon, 80 to 100 cm thick.

Kiskitto complex soils occur largely in the center of large peatlands. The edges of these peatlands are generally not as deep and Atik soils and others are found there.

Medard Series - MDR and Medard Series, peat phase - MDRp

The Medard series consists of Rego Gleysol soils developed on deep, moderately to strongly calcareous fine textured lacustrine sediments. The upper mineral materials are usually very fine, massive clay; the subsoil is often weakly varved with thin silty lenses. These soils occur on level to very gently sloping terrain, usually in the lower slope position. Surface runoff is slow to ponded and internal soil permeability is also slow because of the fine textured materials. Lateral seepage tends to take place along the contact of the peaty surface layers and the less permeable massive clay substrate. Groundwater is at or near the surface in spring and remains high for most of the year. Native vegetation is mainly black spruce with a ground cover of ericaceous shrubs, horsetail, a continuous carpet of feather mosses and occasional hummocks of Sphagnum moss.

The Medard, peaty phase soils are characterized by a 15 to 40 cm thick layer of mesic forest peat on the surface. They may have a thin, dark gray Ah horizon less than 5 cm thick; however, most Medard soils have little or no A horizon and are characterized by a strongly gleyed, pseudo granular, clay subsoil immediately underlying the thin, peaty surface. This subsoil grades into a varved clay.

Associated soils are shallow, poorly drained Atik soils, as well as imperfectly drained Roe Lake and Thompson Lake soils.

Nekik Lake Complex - NKL

The Nekik Lake complex consists of poorly drained Mesic Organic Cryosol and Fibric Organic Cryosol soils developed on deep (>100 cm), moderately well and slightly decomposed, forest and Sphagnum moss peat, underlain by undifferentiated mineral materials. These soils are permanently frozen below a depth of 50 to 60 cm (active layer). The permafrost usually extends well into the underlying mineral substrate. The frozen materials may contain moderate to high amounts of crystal and vein ice. At greater depth, ice lenses of various thicknesses can be encountered. Nekik Lake soils are most often found on frozen peat landforms like palsas and peat plateaus. Native vegetation consists of open to closed black spruce stands with various amounts of ericaceous shrubs like Labrador tea. Dominant ground cover species are feather mosses and Sphagnum mosses.

The Mesic Organic Cryosol soil is characterized by a thin (5 to 25 cm) surface layer of undecomposed fibric feathermoss or Sphagnum moss peat. The remainder of the active layer is comprised of moderately well decomposed, strongly acid, mesic forest peat. The frozen portion of the organic stratum is moderately well to well decomposed, mesic, forest peat, dark brown in color, fine fibered and strongly acid. Usually, a thin layer of black humic forest peat occurs at the contact between the permanently frozen organic material and the active layer. Soft, woody material is common throughout the organic materials.

The Fibric Organic Cryosol soil differs from the Mesic Organic Cryosol in having dominantly fibric Sphagnum moss in the upper 100 cm of its profile rather than moderately decomposed feathermosses.

The Nekik Lake soils of the survey area occur in close association with Atik complex and Hargrave complex soils. The Nekik Lake soils are not widespread and occur in this area in the form of slightly raised strings and hummocks. Surface pattern discernible on aerial photographs suggests that these soils may have been more widely distributed in the past, but have largely disappeared due to the melting of permafrost.

A description of a Nekik Lake soil from the survey area is presented in Appendix A.

Pakwa Series - PKW

The Pakwa series consists of imperfectly drained Gleyed Eluviated Dystric Brunisol soils developed on deep (>100 cm), noncalcareous, sandy or stratified sandy and loamy, glacio-fluvial deposits. These soils occur in level and lower positions of gently to moderately sloping blanket deposits and in pockets of bedrock landscapes. They have rapid permability, very slow surface runoff and a medium water table during the growing season. Pakwa soils are non-eroded, non-stony and non-saline. They have low available water holding capacity and low organic matter content. Native vegetation includes jack pine and black spruce stands with a ground cover of ericaceous shrubs and feathermosses. The majority of these soils are currently under forest cover or have been used for sand extraction.

A representative profile of Pakwa soil is approximately 50 cm thick. The profile is characterized by a neutral, slightly to moderately decomposed, moss and needles LF horizon, 2 to 8 cm thick; a strongly acidic, sand, Ae horizon, 3 to 6 cm thick; a strongly acidic, sand Bm horizon, 30 to 40 cm thick; and a neutral, fine sand Cgj horizon with iron stains. The parent material is typically stratified or bedded with gravelly lenses. A typical profile also contains some free calcium carbonates in the C horizon where groundwater fluctuates; however, in the study area these soils are free of carbonates.

An example profile of a Pakwa soil is presented in Appendix A.

Partridge Crop Series - PCP

The Partridge Crop series consists of rapid to moderately well drained Eluviated Dystric Brunisol soils developed on deep (>100 cm), noncalcareous, coarse sandy and gravelly, glacio-fluvial deposits. These soils occur on crest, mid and lower positions of gently to steeply sloping blanket, terraced and ridged landforms. They have rapid to moderate permeability, very slow surface runoff and a deep water table during the growing season. Partridge Crop soils are non-eroded, non to slightly stony and non-saline. They have low available water holding capacity and low organic matter content. Native vegetation consists of jack pine and black spruce stands with a ground cover of ericaceous shrubs, feathermosses and lichens. The majority of these soils are currently under forest cover, but some areas have been excavated for sand and gravel extraction.

A representative profile of Partridge Crop soil is approximately 50 to 70 cm thick. The profile is characterized by an acidic, moss and needles LF horizon, 2 to 8 cm thick; a strongly acidic, sand Ae horizon, 4 to 10 cm thick; a strongly acidic, gravelly sand Bm horizon, 30 to 40 cm thick; a moderately acidic, gravelly sand BC horizon, 15 to 30 cm thick; and slightly acidic to neutral, gravelly sand C horizon. The parent material is typically stratified or bedded with gravelly or cobbly lenses.

These soils occur in association with Clarke and Pakwa soils.

Pipun Series - PPU

The Pipun series consists of moderately well drained Orthic Gray Luvisol soils developed on a mantle (30 to 75 cm) of moderately to strongly calcareous, clayey, lacustrine sediments over very strongly calcareous, fine silty and fine loamy, lacustrine deposits. These soils occur in middle to upper slope positions of gently to moderately sloping, undulating blanket landscapes. They have moderate permeability, slow surface runoff and low water table during the growing season. Pipun soils are non-eroded, non-stony and non-saline. They have high available water holding capacity and low organic matter content. Native vegetation includes black spruce, jack pine and trembling aspen. Alder shrub occurs often as a tall shrub layer. Ground cover is dominantly feathermosses with some herbs and ericaceous shrubs. The majority of these soils are currently under forest cover.

A representative profile of Pipun soil is approximately 40 cm thick. The profile is characterized by a medium acidic, moderately decomposed LFH horizon, 6 to 15 cm thick, with medium fibered remains of mosses and leaves; a strongly acidic, clay Ae horizon, 4 to 6 cm thick; a very strongly acidic, clay Bt horizon, 25 to 30 cm thick; a strongly calcareous, silty clay Ck horizon, 30 to 35 cm thick; and a very strongly calcareous, silty loam Ck horizon. The parent material is typically laminated (varved) with increasingly thicker silt layers with depth. The transition from clay to loam is usually gradual rather than abrupt.

These soils occur often in association with Wabowden and Sipiwesk soils.

Reed Lake Complex - REX

The Reed Lake complex consists of very poorly drained Terric Mesisols, developed on 40 to 160 cm of mesic peat derived from sedges and other fen vegetation, and of Terric Mesisols, sphagnic phase developed on similar peat materials, but also having a 15 to 60 cm thick Sphagnum peat surface layer. These soils occupy level to depressional areas and are usually underlain by loamy to clayey, moderately to strongly calcareous sediments. The vegetation supported by these soils varies significantly. Soils lacking Sphagnum moss surfaces support vegetation dominated by sedges, reeds, various herbs, brown mosses and in many cases shrubs like alder, willow and swamp birch. Vegetation on sphagnic phase soils usually consists of stunted tamarack, alder and willow shrubs, some ericaceous shrubs and Sphagnum and other mosses.

In the study area, the Reed Lake soils usually have a thin surface layer of Sphagnum mosses. The slightly decomposed Of layer overlies a moderately decomposed Om horizon consisting of a woody peat derived from brown mosses, sedges and shrubs. The mineral subsoil consists of heavy clay textured, calcareous, lacustrine sediments.

Associated soils are the Rock Island complex and the Atik complex soils.

Rock Island Complex - RLX

The Rock Island complex consists of very poorly drained, Typic Mesisols developed on 160 cm or more of mesic sedge peat and Typic Mesisol, sphagnic phase soils developed on similar materials but also having a 15 to 60 cm thick Sphagnum peat surface layer. The topography is depressional to level. Vegetation is similar to that described for the Reed Lake complex soils and varies from sedge dominated communities to those with shrubs and stunted tamarack and mosses.

The Rock Island series, a Typic Mesisol, is the dominant soil in this complex.

Roe Lake Series - ROK

The Roe Lake series consists of Gleyed Gray Luvisol soils developed on deep (>100 cm), moderately to strongly calcareous, fine textured non-stony lacustrine sediments. Surface textures are clay, and the clay textured subsoil is varved with very thin silt lenses. The Roe Lake soils occur on the apex and upper slope position of subdued, very gently sloping terrain and the mid to lower slopes of moderately sloping and undulating areas. The Roe Lake soils are imperfectly drained; surface runoff is slow to moderate and the groundwater level is high (within the profile) during spring runoff and early summer.

The dominant vegetation is black and white spruce with a ground cover of feather mosses. However, disturbance by fire has resulted in mixed forest stands in which jack pine, aspen and birch replace much of the spruce. Such vegetation types also have a dense deciduous shrub layer in the understory.

The Roe Lake soils are moderately well developed, the depth of soil development ranging from 30 to 60 cm. A thin L-F-H horizon (8 to 10 cm thick), comprised mainly of feathermoss and forest litter is underlain by a clay textured Ae horizon and a fine clay Bt horizon. The Bt horizon grades through a transitional BC horizon into a moderately calcareous, massive clay C horizon. The C horizon is gleyed and mottled; both of these features increase in intensity at lower depths in the profile.

Associated soils are Wabowden and Medard soils.

Sipiwesk Series - SWK

The Sipiwesk series consists of moderately well drained Orthic Gray Luvisol soil developed on deep (>100 cm), moderately to strongly calcareous, clayey lacustrine deposits. These soils occur in lower, middle and crest positions of gently to moderately sloping blanket landscapes. They have moderate to slow permeability, slow surface runoff and a low water table during the growing season. Sipiwesk soils are non-eroded, non-stony and non-saline. They have high available water holding capacity and low organic matter content. Native vegetation includes black and white spruce, trembling aspen and jack pine with alder shrub. Ground cover is feather mosses, herbs and low ericaceous shrubs. The majority of these soils are currently in their native state.

A representative profile of Sipiwesk soil is approximately 50 cm thick. The profile is characterized by a weakly to moderately decomposed, medium acidic, very dark brown, moss and forest litter LFH, 5 to 8 cm thick; a medium acid, light gray, clay Ae, 4 to 7 cm thick, with a granular structure; a medium acidic, pale brown, clay AB horizon, 5 to 10 cm thick, with subangular block structure; a medium acidic, brown, clay Bt horizon, 15 to 30 cm thick, with blocky structure, a moderately calcareous, pale brown, clay BC horizon, 15 to 20 cm thick, with granular structure; and a moderately calcareous, light brownish gray, clay Ck, with varves.

Sipiwesk soils occur in close association with Wabowden, Roe Lake and Medard series soils.

Snow Lake Complex - SOW1 and SOW2

The Snow Lake complex consists of Eluviated Dystric and Eutric

Brunisols, lithic phases and bedrock (nonsoil). The Brunisol soils have developed on thin veneers of slightly acidic to neutral, loamy to sandy till and on residual and colluvial materials collected in pockets and bedrock fissures. The complex also includes thin organic deposits of mesic forest and sedge peat accumulated in small bedrock depressions.

The Snow Lake, thick organic material variant (SOW1) areas are characterized by a thick (15 to 30 cm) LFH layer overlying most of the unconsolidated mineral materials as well as large parts of the bedrock. The Snow Lake, thin organic material variant (SOW2) generally lacks this deep LFH layer and more bedrock surface is exposed. Differences in fire history may be the cause of the difference in organic material accumulation. There also is a generally greater accumulation and more widespread presence of residual and colluviated materials in the SOW1 areas compared to the SOW2 areas.

Snow Lake Complex mapping units are usually found on steeply sloping bedrock landscapes with frequent steep-sided ravines. Drainage is generally rapid to moderate except in depressional areas where runoff collects. The shallow soils have moderate available water holding capacity and moderate to high organic matter content. Native vegetation varies from site to site but includes black and white spruce, balsam fir, trembling aspen, white birch and jack pine. Ground cover consists of feather mosses, bunchberry and low ericaceous shrubs. The majority of these soils are currently under forest cover.

A representative profile of a Snow Lake complex soil is approximately 25 cm thick. The profile is characterized by weakly to moderately decomposed, strongly acidic, black, feather moss and forest debris LFH horizon, 8 to 30 cm thick, with occasional rock fragments, a very strongly acidic, dark reddish brown, very fine sandy loam BM1 horizon, 10 to 20 cm thick, with some coarse fragments; a strongly acidic, strong brown, very fine sandy loam Bm2 horizon, 10 to 15 cm thick, with angular coarse fragments overlying bedrock.

Snow Lake soils occur in close association with and include small areas of Fay Lake, Hat Lake and Wolverton series soils.

A description of a representative profile of the Snow Lake complex is presented in Appendix A.

Wabowden Series - WBW

The Wabowden series consists of moderately well to well drained Solonetzic Gray Luvisol soils developed on deep (>100 cm), moderately to strongly calcareous, fine textured lacustrine sediments. The Wabowden soils occur on the apex and upper to mid slope positions of gently to moderately sloping undulating terrain. Surface runoff is moderate; permeability in the upper part of the profile is moderately slow but becomes slow to very slow in the massive clayey subsoil.

Climax vegetation on the Wabowden soils is a black spruce-feathermoss type. Areas disturbed by fire support various successional stages of mixed woods vegetation dominated by jack pine, aspen and birch. Some of these areas have relatively pure stands of jack pine or aspen. A dense deciduous shrub understory is common in aspen stands.

Wabowden soils are relatively deep, being leached free of carbonates to a depth of 40 to 60 cm and occasionally to 80 cm. A thin L-H horizon, comprised mainly of feather mosses is underlain by a light gray moderate, medium, platy Ae horizon, 5 to 10 cm thick. A strong, coarse, platy AB horizon forms a transition between the Ae and the strong, coarse columnar or strong, coarse subangular aggregates of the Btnj horizon. The columns may extend to 40 or 50 cm depth and grade into a massive pseudo blocky BC horizon. However, often the columns don't extend to more than 30 to 35 cm depth and grade into a blocky Bt. The moderately to strongly calcareous, massive or pseudo platy C horizon often contains very fine silt laminae (varves) within the control section.

Associated soils are Thompson Lake and Roe Lake soils.

Waskik Lake Complex - WSK

The Waskik Lake complex consists of very poorly drained Terric Mesisol soils developed on shallow (40 to 160 cm), moderately decomposed fen peat deposits with little or no (<15 cm) sphagnum surface peat. The Waskik Lake soils are underlain by noncalcareous sandy lacustrine or glacio-fluvial deposits. These soils occur on fens which have developed on flat or depressional areas. Surface runoff is ponded and subsurface drainage is moderate to slow due to moderate to poor permeability of the sedge peat. The water table is at or close to the surface for most of the growing season. Native vegetation includes very stunted tamarack and black spruce trees and an extensive swamp birch cover. Ground cover is dominated by sedges, various herbs like bog bean and threeleaf smilacina, brown mosses and patches of sphagnum mosses. The majority of these soils are presently in their native state.

The Waskik Lake complex includes Terric Mesisol and Terric Fibric Mesisol soils. In a representative profile of Waskik Lake soil the peat is 100 to 140 cm thick. The profile is characterized by a thin, broken, non-decomposed, strongly acid, pinkish white, sphagnum peat Of horizon, 0 to 20 cm thick; a slightly decomposed, strongly acidic, dark reddish gray, mixed moss, sedge, herb and leaf Om horizon, 20 to 30 cm thick; a moderately decomposed, strongly acidic, dark reddish brown, nonwoody sedge and brown moss peat Om horizon, 40 to 100 cm thick; and a weakly acidic, light brownish gray, sandy IICg horizon. The peat material is typically stratified with thin fibric layers. These soils occur in close association with Gormley Lake soils, which may occur along the edge of Waskik Lake peatlands. Reed Lake soils occur in deeper sections of Waskik Lake peatlands.

Wolverton Series - WVT

The Wolverton series consists of well drained Eluviated Dystric Brunisol, lithic phase soils developed on shallow (<100 cm) of noncalcareous, coarse loamy to sandy morainal (till) deposits. These soils occur in middle, upper and crest positions of moderately to strongly sloping veneer landscapes. They have rapid permeability, very slow surface runoff and a deep water table during the growing season. Wolverton soils are non-eroded, moderately to exceedingly stony and non-saline. They have low available water holding capacity and low organic matter content. Native vegetation includes jack pine, black spruce, trembling aspen and white birch. Groundcover is feathermosses, lichens and low ericaceous shrubs. The majority of these soils are currently in their native state.

A representative profile of Wolverton soil is approximately 50 cm thick. The profile is characterized by an extremely acidic, slightly decomposed, dark reddish brown, moss and forest debris LF horizon, 2 to 10 cm thick; an extremely acidic, dark grayish brown, loamy coarse sand Ae horizon, 5 to 15 cm thick, with gravel and cobbles; an extremely acidic, reddish brown, skeletal coarse sand Bfj, 25 to 35 cm thick, with gravel and cobbles; and a strongly acidic, yellowish brown, skeletal coarse sand C over bedrock.

Wolverton soils occur in close association with Fay Lake and Hat Lake series soils and bedrock (nonsoil).

A representative profile of a Wolverton soil is presented in Appendix A.

PART 4

USE AND MANAGEMENT INTERPRETATIONS OF SOILS

4.1 Introduction

This section provides predictions of performance or soil suitability ratings for various uses of soils based on field observations of soil and landscape characteristics, laboratory data and on observations of soil behavior under specified conditions of land use and management. Suitability ratings or interpretations are intended only to serve as guides for planners and managers. Caution, with an understanding of the limitations of the soil map must be exercised when applying suitability ratings to soil map units. The value of any rating or interpretation depends upon the nature and composition of individual map unit delineation, which in turn depends on the scale of mapping and intensity of ground truthing employed in the survey.

In this section, interpretive soil information is provided for the following land use evaluations:

1. Forestry Capability
2. Engineering Uses
3. Recreation Uses

4.2 Soil Capability for Forestry

Soil capability classification for forestry is based on evaluation of both internal and external soil characteristics that influence soil suitability and limitations for the growth of timber. In this classification the mineral and organic soils are grouped according to three categories as outlined in the Land Capability Classification for Forestry (McCormack, 1970). The three categories are: capability classes, capability subclasses and indicator species. It is important to note that in the Canada Land Inventory classification, the Capbility Class is an expression of all the environmental factors as they apply to tree growth. In the soil capability classification the ratings are applied to soil series and soil phases concepts rather than a particular area of land. Consequently, a number of environmental factors like local climate, aspect, bedrock distribution which may effect the growth of timber positively or negatively are not considered. Therefore, the same soil occurring in the landscape in different localities may support different measurable growth rates; however, differences will likely be small enough that growth rates will still fall within the same broad classes. Thus, in this report the categores and their definitions are as follows:

The Capability Class. The environment of subsoil, soil and general surface form and regional climate as well as characteristic tree species are taken into account when assigning a soil to a given class. The capability class, then, is an expression of soil factors and some climate factors as they apply to tree growth.

The Capability Subclass. Subclasses are the factors which limit tree growth. The kinds of limitation are important when they affect management. or can be corrected. The degree of limitation determines the class designation.

The Indicator Species. The tree species that can be expected to yield the volume associated with each class are shown as part of the symbol. Only indigenous species adapted to the region and land are shown.

Conventions (after McCormack, 1970)

1. When the highest class in a region has no subclass associated with it, regional climate may be assumed to be the limiting factor. Different soils may have the same capability rating, but for different reasons. The types of limitations are shown in the subclass.

2. Associated with each capability class is a productivity range based on the mean annual increment (MAI) of the best species or group of species adapted to the site (soil) at, or near, rotation age. Productivity ranges are expressed in gross merchantable volume (m^3/ha per annum or cubic feet/acre per annum) down to a minimum diameter of 10 cm (4 inches). The productivity ranges are for "normal" or fully-stocked stands. Thinnings, bark and branch wood are not included.

3. Ratings are based on the natural state of the land without improvements such as fertilization, drainage or other amelioration.

Capability Classes

As classes 1, 2 and 3 do not occur in the area only the classes 4 to 7 are defined.

Class 4 - Lands having moderately severe limitations to the growth of commercial forests

Soils may vary from deep to moderately shallow, from excessive through imperfect to poor drainage, from coarse through fine texture, from good to poor water-holding capacity, from good to poor structure and from good to low natural fertility. The most common limitations are: deficiency or excess of soil moisture, adverse climate, restricted rooting depth, poor structure, or low fertility. Productivity is usually from 51 to 70 cubic feet per acre per annum (3.6-4.9 m^3/ha per annum).

Class 5 - Lands having severe limitations to the growth of commercial forests

Soils are frequently shallow to bedrock, stony, excessively or poorly drained, of coarse or fine texture, may have poor water-holding capacity and be low in natural fertility. The most common limitations (often in combination) are: deficiency or excess of soil moisture, shallowness to bedrock, adverse regional climate, low natural fertility, and excessive stoniness. Productivity is usually from 31 to 50 cubic feet per acre per annum (2.2-3.5 m^3/ha per annum).

Class 6 - Lands having very severe limitations to the growth of commercial forests

The mineral soils are frequently shallow, stony, excessively drained, of coarse texture and low in fertility. However, most of the land in this class consists of poorly drained organic soils. The most common limitations (frequently in combination) are: shallowness to bedrock, deficiency or excess of soil moisture, low natural fertility, inundation and stoniness. Productivity is usually from 11 to 30 cubic feet per acre (0.8 to 2.1 m^3/ha per annum).

Class 7 - Lands having severe limitations which preclude the growth of commercial forests

Mineral soils are usually extremely shallow to bedrock, subject to regular flooding, or contain toxic levels of soluble salts. Actively eroding or extremely dry soils may also be placed in this class. However, most of the land in this class consists of very poorly drained organic soils. The most common limitations are: shallowness to bedrock, excessive soil moisture, frequent inundation, and extremes of climate. Productivity is usually less than 10 cubic feet per acre per annum (<0.7 m^3/ha per annum).

Capability Subclasses

Subclass symbols, when shown, always represent a limitation to growth and are used only when the limitations they represent affect the class level. When the limitations are advantageous, or not severe enough to affect the class level, they are not shown.

Climate. Subclasses are used to denote a significant adverse departure from what is considered to be the median climate of the region, that is, a limitation as a result of local climate; adverse regional climate is expressed by the class level. The symbols used and the limitations they represent are as follows:

A - drought or aridity as a result of climate

C - a combination of more than one climatic factor, or two or more features of climate that have significance

H - low temperatures - that is, too cold

U - exposure

Soil Moisture. These subclasses denote that the soil moisture is less than optimum for the growth of commercial forests; but they do not include inundation. The symbols used and the limitations they represent are as follows:

M - soil moisture deficiency

W - excess soil moisture

X - a pattern of "M" and "W" too intimately associated to map separately

Z - a pattern of wet organic soils and bedrock too intimately associated to map separately

Permeability and Depth of Rooting Zone. These subclasses denote limitations of soil permeability, or physical limitations to rooting depth. The symbols used and the limitations they represent are as follows:

D - physical restriction to rooting caused by dense or consolidated layers, other than bedrock

R - restriction of rooting zone by bedrock

Y - intimate pattern of shallowness and compaction, or other restricting layers

K - restriction (physical and thermal) to rooting due to permafrost. (In organic soils permafrost may be beneficial to tree growth as drainage is improved due to the elevation of frozen peatlands above surrounding terrain).

Other Soil Factors

These subclasses denote factors of the soil which affect growth, either individually or in combination. The symbols used and the limitations they represent are as follows:

E - actively eroding soils

F - low fertility

I - soils periodically inundated by streams or lakes

L - excessive levels of calcium

N - excessive levels of toxic elements, such as soluble salts

P - stoniness which affects forest density or growth

S - a combination of soil factors, none of which affect the class level by themselves, but which cumulatively lower the capability class

Table 4. Soil Capability for Forestry

Map Symbol and Phase	Soil Name	Capability Class	Subclass	Indicator Species
ARC/cx	Acidic Bedrock	7	R	jP
ARC/ex	Acidic Bedrock	7	R	jP
ARC/fx	Acidic Bedrock	7	R	jP
ARC/gx	Acidic Bedrock	7	R	jP
ARC/hx	Acidic Bedrock	7	R	jP
ATK	Atik	7	W	bS
BTW/d2	Burntwood	5	M	jP, bS
BTW/e2	Burntwood	5	M	jP, bS
DRL/cx	Drunken Lake	5	M	bS, jP
DRL/c1	Drunken Lake	5	M	bS, jP
DRL/dx	Drunken Lake	5	M	bS, jP
DRL/d1	Drunken Lake	5	M	bS, jP
DRL/ex	Drunken Lake	5	MR	bS, jP
DRL/e1	Drunken Lake	5	MR	bS, jP
DRL/e2	Drunken Lake	5	MR	bS, jP
FLL	File Lake	7(6)	W	bS, tL
FXL	Flux Lake	6	W	bS
FYK	Fay Lake	5(4)	M	bS, jP
FYK/c2	Fay Lake	5(4)	M	bS, jP
FYK/dx	Fay Lake	5	M	bS, jP
FYK/d2	Fay Lake	5	M	bS, jP
FYK/d3	Fay Lake	5	M	bS, jP
FYK/e2	Fay Lake	5	M	bS, jP
FYK/e3	Fay Lake	5	M	bS, jP
FYK/f2	Fay Lake	5	M	bS, jP
FYK/f3	Fay Lake	5	M	bS, jP
FYK/g3	Fay Lake	5	M	bS, jP
GRY	Gromely Lake	6(7)	W	bS
HGR	Hargrave	6(7)	W	bS
HTK/x2	Hat Lake	5(4)	M	bS, jP
HTK/c3	Hat Lake	5(4)	M	bS, jP
KHX	Kiskitto	7	W	bS
MDR	Medard	6(5)	W	bS
MDRp	Medard, peaty phase	6	W	bS
NKL*	Nekik Lake	6(7)	K	bS
PCP/d1	Partridge Crop	6(5)	M	jP, bS
PCP/f2	Partridge Crop	6(5)	M	jP, bS
PKW	Pakwa	5(6)	W	bS
PPU/cx	Pipun	5(4)	M	bS, jP
PPU/d2	Pipun	5(4)	M	bS, jP

Map Symbol and Phase	Soil Name	Capability Class	Subclass	Indicator Species
REX	Reed Lake	7	W	-
RLX	Rock Island	7	W	-
ROK	Roe Lake	5(4)	M	bS, jP
ROK/cx	Roe Lake	5(4)	M	bS, jP
ROK/cl	Roe Lake	5(4)	M	bS, jP
ROK/dx	Roe Lake	5(4)	M	bS, jP
ROK/ex	Roe Lake	5(4)	M	bS, jP
SOW1/f3	Snow Lake	5(6,4)	MR	jP, bS
SOW1/g3	Snow Lake	5(6,4)	MR	jP, bS
SOW1/i2	Snow Lake	5(6,4)	MR	jP, bS
SOW1/i3	Snow Lake	5(6,4)	MR	jP, bS
SOW2/e2***	Snow Lake	5(6)	MR	jP
SOW2/e3	Snow Lake	6(5)	MR	jP
SOW2/f2	Snow Lake	6(5)	MR	jP
SOW2/f3	Snow Lake	6(5)	MR	jP
SOW2/g3	Snow Lake	6	MR	jP
SOW2/h2	Snow Lake	6(5)	MR	jP
SOW2/h3	Snow Lake	6	MR	jP
SWK/cl	Sipiwesk	4(5)	M	bS, jP
SWK/dx	Sipiwesk	5(4)	MD	bS, jP
WBW	Wabowden	5(4)	MD	bS, jP
WBW/xl	Wabowden	5(4)	MD	bS, jP
WBW/cx	Wabowden	5(4)	MD	bS, jP
WBW/cl	Wabowden	5(4)	MD	bS, jP
WBW/dx	Wabowden	5(4)	MD	bS, jP
WBW/dl	Wabowden	5(4)	MD	bS, jP
WSK	Waskik	7	W	-
WVT/d2	Wolverton	5(6)	MR	jP, bS
WVT/e3	Wolverton	5(6)	MR	jP, bS
WVT/f2	Wolverton	5(6)	MR	jP, bS

* Frozen soils. Capability rating for undisturbed soil with permafrost present.

** SOW1 capability rating for average site condition. The ratings between brackets indicate variation in capability due to soil material depth, exposure and aspect.

*** SOW2 capability rating for average site condition. The ratings between brackets indicate variation in capability due to better soil and moisture conditions.

4.3 Soil Suitability for Selected Engineering Uses

This section provides information which can be used by engineers and land use planners concerned with engineering and related geotechnical aspects of soil. It is intended to supplement the information on the soil map with additional data on engineering properties of soils.

The criteria used to evaluate soil suitability for selected engineering and related recreational uses are from guidelines developed by the Soil Conservation Service, United States Department of Agriculture, USDA, 1971 and adopted by the Canada Soil Survey Committee (CSSC, 1973).

Definition of Soil Suitability Classes

Evaluation of soil suitability for engineering and recreation uses is based on both internal and external soil characteristics. Four soil suitability classes are used to evaluate both mineral and organic soils and hence, mapping units for selected uses. These ratings express relative degrees of suitability or limitation for potential uses of natural or essentially undisturbed soils. The long term effects of the potential use on the behavior of the soil are considered in the rating.

The four suitability class ratings are defined as follows:

Good - Soils in their present state have few or minor limitations that would affect the proposed use. The limitations would easily be overcome with minimal cost.

Fair - Soils in their present state have one or more moderate limitations that would affect the proposed use. These moderate limitations would be overcome with special construction, design, planning or maintenance.

Poor - Soils in their present state have one or more severe limitations that would severely affect the proposed use. To overcome these severe limitations would require the removal of the limitation or difficult and costly alteration of the soil or of special design or intensive maintenance.

Very Poor-Soils have one or more features so unfavorable for the proposed use that the limitation is very difficult and expensive to overcome or the soil would require such extreme alteration that the proposed use is economically impractical.

Soil Suitability Subclasses

The basic soil properties that singly or in combination with others commonly affect soil suitability for selected engineering properties and recreation uses are provided in Table 5. These subclass designations serve to identify the kind of limitation or hazard for a particular use.

Guides for Assessing Soil Suitability

Guides for assessing soil suitability for ten engineering related uses are given in Appendix E, Tables 12 to 21. These tables provide as specifically as possible, definitions of the soil properties which result in the specific suitability or degree of limitation. In assessing soil suitability for various engineering uses, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed soil properties. For example, if the suitability is "Good" for all but one soil property and it is estimated to be "Very Poor", then the overall rating of the soil for that selected use is "Very Poor". Suitability of individual soil properties, if estimated to be "Fair" or "Poor", can be accumulative in their effect for a particular use. Judgement is required to determine whether the severity of the combined effects of several soil properties on suitability for a particular use will result in downgrading an evaluation. This is left to the discretion of the interpreter. It is incorrect to assume that each of the major soil properties influencing a particular use has an equal effect. Class limits established for rating the suitability of individual soil properties take this into account. For a selected use, therefore, only those soil properties which most severely limit that use are specified.

The soils have been rated according to their suitability for ten selected engineering uses (Table 6). When using these interpretations, consideration must be given to the following assumptions:

1. Interpretations are based on predictions of soil behavior under defined conditions of use and management as specified in the preamble to each of Tables 8 through 17 (Appendix E).

2. Soil ratings do not include site factors such as nearness to towns and highways, water supply, aesthetic values, etc.

3. Soil ratings are based on natural, undisturbed soil.

4. Soil suitability ratings are usually given for the entire soil, but for some uses, they may be based on the limitations of an individual soil horizon or other earthy layer, because of its overriding importance. Ratings rarely apply to soil depths greater than 1 to 2 meters, but in some kinds of soils, reasonable estimates can be given for soil material at greater depths. It should be noted here that the term "soil" has been used throughout the report in the pedologic sense and differs in concept from that commonly used by engineers.

5. Poor and very poor soil ratings do not imply that a site cannot be changed to remove, correct or modify the soil limitations. The use of soils rated as poor depends on the nature of the limitations, whether or not the soil limitation can be altered successfully and economically, and on the scarcity of good sites.

6. Interpretations of map units do not eliminate the need for on-site evaluation by qualified professionals. Due to the variable nature of soils, and the scale of mapping, small, unmappable inclusions of soils with different properties may be present in an area where a development is planned. The need for or importance of on-site studies depends on the use to be made of the soil and the kinds of soil and soil problems involved.

Table 5. Codes Utilized to Identify Limitations in Evaluating Soil Suitability for Selected Engineering and Recreational Uses (Tables 6 and 7)

a	subgrade properties
b	thickness of topsoil
c	coarse fragments on surface
d	depth to bedrock
e	erosion or erodibility
f	susceptibility to frost hazard
g	contamination hazard of groundwater
h	depth to seasonal water table
i	flooding or inundation
j	thickness of slowly permeable material
k	permeability or hydraulic conductivity
l	shrink-swell properties
m	moisture limitations or deficit
n	salinity or sulphate hazard
o	organic matter
p	stoniness
q	depth to sand or gravel
r	rockiness
s	surface texture
t	topographic slope class
u	moist consistence
w	wetness or soil drainage class
z	permafrost

Table 6. Suitability Ratings of Soils for Selected Engineering Uses

Map Symbol and Phase	Soil Name	Top-soil (8)	Sand & Gravel (9)	Road-fill (10)	Permanent Bldgs. with Basements (11)	Local Roads and Streets (12)	Sanitary Trench (13)	Landfill Area (14)	Cover Material (15)	Sewage Lagoon (16)	Septic Fields (17)
ARC/cx	Acidic Bedrock	Vb	Va	Vr	Vr	Vr	Vd	Pk	Vd	Vd	Vd
ARC/ex	Acidic Bedrock	Vb	Va	Vr	Vrt	Vrt	Vd	Pk	Vd	Vdt	Vd
ARC/fx	Acidic Bedrock	Vb	Va	Vr	Vrt	Vrt	Vdt	Vkt	Vd	Vdt	Vd
ARC/gx	Acidic Bedrock	Vb	Va	Vr	Vrt	Vrt	Vdt	Vtk	Vd	Vdt	Vd
ARC/hx	Acidic Bedrock	Vb	Va	Vr	Vrt	Vrt	Vdt	Vtk	Vd	Vdt	Vd
ATK	Atik	Vw	Va	Vaw	Vaw	Faw	Vw	Vkw	Vsw	Vh	Vh
BTW/d2	Burntwood	Psu	Va	Pal	Pa	Pa	Pks	G	Ps	Pk	Fg
BTW/e2	Burntwood	Psu	Va	Pal	Pa	Pa	Pks	Ft	Ps	Vkt	Fgt
DRL/cx	Drunken Lake	Psu	Va	Paf	Pda	Pad	Vd	G	Pds	Pd	Pak
DRL/cl	Drunken Lake	Psu	Va	Paf	Pda	Pad	Vd	G	Pds	Pd	Pak
DRL/dx	Drunken Lake	Psu	Va	Paf	Pda	Pad	Vd	G	Pds	Pdt	Pdk
DRL/dl	Drunken Lake	Psu	Va	Paf	Pda	Pad	Vd	G	Pds	Pdt	Pdk
DRL/ex	Drunken Lake	Psu	Va	Paf	Pdt	Pad	Vd	Ft	Pds	Vtd	Pdk
DRL/el	Drunken Lake	Psu	Va	Paf	Pdt	Pad	Vd	Ft	Pds	Vtd	Pdk
DRL/e2	Drunken Lake	Psu	Va	Paf	Pdt	Pad	Vd	Ft	Pds	Vtd	Pdk
FLL	File Lake	Vw	Va	Vwa	Vha	Va	Vws	Vw	Vsw	Vai	Vh
FXL	Flux Lake	Pws	Va	Va	Vaw	Vaw	Vws	Vwh	Vsw	Vah	Vhg
FYK	Fay Lake	Vc	Fa	G	Fp	G	Vk	Vk	Fc	Vk	Gg
FYK/c2	Fay Lake	Vc	Fa	G	Fp	G	Vk	Vk	Fc	Vk	Gg
FYK/dx	Fay Lake	Vc	Fa	G	Fp	G	Vk	Vk	Fc	Vk	Gg
FYK/d2	Fay Lake	Vc	Fa	G	Fp	G	Vk	Vk	Fc	Vk	Gg
FYK/d3	Fay Lake	Vc	Fa	G	Pp	G	Vkp	Vk	Pp	Vk	Gg
FYK/e2	Fay Lake	Vc	Fa	G	Fp	G	Vk	Vk	Fc	Vkt	Fgt
FYK/e3	Fay Lake	Vc	Fa	Fp	Pp	Fp	Vkp	Vk	Pp	Vkt	Fqt
FYK/f2	Fay Lake	Vc	Fa	Ft	Pt	Pt	Vk	Vkt	Pt	Vkt	Pqt
FYK/f3	Fay Lake	Vc	Fa	Ftp	Ptp	Ptp	Vkp	Vkt	Ptp	Vkt	Pgt
FYK/g3	Fay Lake	Vc	Fa	Ftp	Ptp	Ptp	Vkp	Vkt	Ptp	Vkt	Pqt
GRY	Gormley Lake	Pws	Va	Va	Vwa	Vaw	Vaw	Vhw	Vsw	Vha	Vh
HGR	Hargrave	Vw	Va	Vaw	Vwa	Vaw	Vws	Vhw	Vsw	Vha	Vh
HTK/x2	Hat Lake	Vc	Fa	G	Pw	Fw	Vk	Vk	Fc	Vk	Fhq

Table 6 (cont'd)

Map Symbol and Phase	Soil Name	Top-soil (8)	Sand & Gravel (9)	Road-fill (10)	Permanent Bldgs. with Basements (11)	Local Roads and Streets (12)	Sanitary Trench (13)	Landfill Area (14)	Cover Material (15)	Sewage Lagoon (16)	Septic Fields (17)
HTK/c3	Hat Lake	Vc	Pa	G	Pw	Fw	Vk	Vk	Fc	Vk	Fhq
KHX	Kiskitto	Pws	Va	Va	Vaw	Vaw	Vws	Vwh	Vsw	Vah	Vhq
MDR	Medard	Pws	Va	Pwa	Ph	Paw	Vw	Pw	Psw	G	Vh
MDRp	Medard, peaty phase	Pws	Va	Pwa	Ph	Paw	Vw	Pw	Psw	G	Vh
[1]NKL	Nekik Lake	Vw	Va	Vaw	Vwa	Vaw	Vws	Vhw	Vsw	Vha	Vh
PCP/d1	Partridge Crop	Vcb	G	G	G	G	Vsk	Vk	Vs	Vka	Gq
PCP/f2	Partridge Crop	Vcb	G	G	G	G	Vsk	Vk	Vs	Vka	Gq
PKW	Pakwa	Ps	Pa	Fw	Pw	Fw	Vks	Vk	Vs	Vk	Fhg
PPU/cx	Pipun	Psu	Va	Paf	Paf	Paf	Pws	G	Fs	Fht	Pk
PPU/d2	Pipun	Psu	Va	Paf	Paf	Paf	Pws	G	Fs	Pt	Pk
REX	Reed Lake	Vw	Va	Vaw	Vwa	Vaw	Vws	Vhw	Vsw	Vha	Vh
RLX	Rock Island	Vw	Va	Vaw	Vwa	Vaw	Vws	Vhw	Vsw	Vha	Vh
ROK	Roe Lake	Psu	Va	Paf	Pwa	Paf	Pws	Fw	Ps	Fh	Pkh
ROK/cx	Roe Lake	Psu	Va	Paf	Pwa	Paf	Pws	Fw	Ps	Fht	Pkh
ROK/cl	Roe Lake	Psu	Va	Paf	Pwa	Paf	Pws	Fw	Ps	Fht	Pk
ROK/dx	Roe Lake	Psu	Va	Paf	Pwa	Paf	Pws	Fw	Ps	Pt	Pk
ROK/ex	Roe Lake	Psu	Va	Paf	Pwa	Paf	Pws	Fw	Ps	Pt	Pk
[2]SOW1/f3	Snow Lake, phase 1	Vb	Va	Vr	Vrt	Vrt	Va	Vtk	Vat	Vdt	Vdt
SOW1/g3	Snow Lake, phase 1	Vb	Va	Vr	Vrt	Vrt	Vd	Vtk	Vdt	Vdt	Vdt
SOW1/i2	Snow Lake, phase 1	Vb	Va	Vr	Vrt	Vrt	Vd	Vtk	Vat	Vat	Vdt
SOW1/f3	Snow Lake, phase 1	Vb	Va	Vr	Vrt	Vrt	Vdt	Vtk	Vd	Vdt	Vd
SOW2/e2	Snow Lake, phase 2	Vb	Va	Vr	Vrt	Vrt	Vdt	Pk	Vd	Vd	Vd
SOW2/e3	Snow Lake, phase 2	Vb	Va	Vr	Vrt	Vrt	Vdt	Pk	Vd	Vd	Vd
SOW2/f2	Snow Lake, phase 2	Vb	Va	Vr	Vrt	Vrt	Vdt	Pk	Vd	Vd	Vd
SOW2/g3	Snow Lake, phase 2	Vb	Va	Vr	Vrt	Vrt	Vdt	Vtk	Vdt	Vdt	Vdt
SOW2/h2	Snow Lake, phase 2	Vb	Va	Vr	Vrt	Vrt	Vdt	Vtk	Vdt	Vdt	Vdt
SOW2/h3	Snow Lake, phase 2	Vb	Va	Vr	Vrt	Vrt	Vdt	Vtk	Vdt	Vdt	Vdt
SWK/cl	Sipiwesk	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	G	Pk
SWK/dx	Sipiwesk	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	Pt	Pk
WBW	Wabowden	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	G	Pk

Table 6 (cont'd)

Map Symbol and Phase	Soil Name	Top-soil (8)	Sand & Gravel (9)	Road-fill (10)	Permanent Bldgs. with Basements (11)	Local Roads and Streets (12)	Sanitary Trench (13)	Landfill Area (14)	Cover Material (15)	Sewage Lagoon (16)	Septic Fields (17)
WBW/x1	Wabowden	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	G	Pk
WBW/cx	Wabowden	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	Ft	Pk
WBW/cl	Wabowden	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	Ft	Pk
WBW/dx	Wabowden	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	Pt	Pk
WBW/dl	Wabowden	Psu	Va	Paf	Faf	Paf	Ps	G	Psu	Pt	Pk
WSK	Waskik Lake	Vw	Va	Vaw	Vaw	Vaw	Vsw	Vkw	Vsw	Vah	Vh
WVT/d2	Wolverton	Vc	Fa	Fd	Pd	Fd	Vdk	Vk	Pdc	Ptd	Pdg
WVT/e3	Wolverton	Vc	Fap	Fd	Ptd	Ptd	Vdk	Vk	Pdc	Vt	Pdg
WVT/f2	Wolverton	Vst	Fa	Fdt	Ptd	Ptd	Vdk	Vk	Pdc	Vt	Pdg

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[1] Frozen soils. Ratings for disturbed soil after permafrost has melted (unless otherwise indicated).

[2] SOW1 and SOW2 have been rated as bedrock. Local areas occur that are more suitable for a particular use than the rating indicates.

4.4 Soil Suitability for Selected Recreation Uses

This section provides interpretations of the soil suitability for recreational development. All types of soil can be used for recreational activities of some kind.

Soils and their properties determine to a large degree, the type and location of recreational facilities. Wet soils are not suitable for campsites, roads, playgrounds or picnic areas. Soils that pond and dry out slowly after heavy rains present problems where intensive use is contemplated. It is difficult to maintain grass cover for playing fields and golf courses on droughty soils. The feasibility of many kinds of outdoor activities are determined by other basic soil properties such as depth to bedrock, stoniness, topography or land pattern, and the ability of the soil to support vegetation of different kinds as related to its natural fertility.

The suitability of the various soil series and phases for selected recreation uses is shown in Table 7 according to four classes, Good, Fair, Poor and Very Poor defined previously in the section on Engineering Uses. Subclasses are employed to identify the kind of limitation or hazard for a particular use. An explanation of subclass symbols are provided in Table 5.

The guidelines for various recreation uses are presented in Appendix E, Tables 18 to 21 and 11.

Table 7. Suitability Ratings of Soils for Recreational Uses

Map Symbol and Phase	Soil Name	Play-ground (18)	Picnic Area (19)	Camp Area (20)	Paths & Trails (21)	Permanent Bldgs. without Basements (11)
ARC/cx	Acidic Bedrock	Vr	Vr	Vr	Vr	Vr
ARC/ex	Acidic Bedrock	Vrt	Vr	Vr	Vr	Vr
ARC/fx	Acidic Bedrock	Vrt	Vr	Vr	Vr	Vrt
ARC/gx	Acidic Bedrock	Vrt	Vrt	Vr	[illegible]	
ARC/hx	Acidic Bedrock	Vrt	Vrt	Vrt	Vrt	
ATK	Atik	Vsw	Vsw	Vsw	Vsw	Vaw
BTW/d2	Burntwood	Pst	Fs	Fs	Fs	Pa
BTW/e2	Burntwood	Vt	Fst	Fst	Fs	Pa
DRL/cx	Drunken Lake	Fst	Fs	Fs	Fs	Pda
DRL/c1	Drunken Lake	Fst	Fs	Fs	Fs	Pda
DRL/dx	Drunken Lake	Pt	Fs	Fs	Fs	Pda
DRL/d1	Drunken Lake	Pt	Fs	Fs	Fs	Pda
DRL/ex	Drunken Lake	Vt	Fst	Fst	Fst	Pta
DRL/e1	Drunken Lake	Vts	Fst	Fst	Fst	Pta
DRL/e2	Drunken Lake	Vts	Fst	Fst	Fst	Pta
FLL	File Lake	Vws	Vws	Vws	Vws	Va
FXL	Flux Lake	Vsw	Vsw	Vsw	Vsw	Vaw
FYK	Fay Lake	Pc	Fsc	Fsc	Fc	G
FYK/c2	Fay Lake	Pc	Fsc	Fsc	Fc	G
FYK/dx	Fay Lake	Ptc	Fsc	Fsc	Fc	G
FYK/d2	Fay Lake	Ptc	Fsc	Fsc	Fc	G
FYK/d3	Fay Lake	Ptc	Fsc	Pp	Fcp	Fp
FYK/e2	Fay Lake	Vtc	Ftc	Fsc	Fc	Ft
FYK/e3	Fay Lake	Vtc	Ftc	Pp	Fcp	Ftp
FYK/f2	Fay Lake	Vtc	Ptc	Ptp	Ftp	Ptp
FYK/f3	Fay Lake	Vtc	Ptc	Ptp	Ftp	Ptp
FYK/g3	Fay Lake	Vtc	Ptc	Ptp	Ftp	Ptp
GRY	Gormley Lake	Vsw	Vsw	Vsw	Vsw	Vaw
HGR	Hargrave	Vsw	Vsw	Vsw	Vsw	Vaw
HTK/x2	Hat Lake	Pc	Fsc	Fsc	Fc	Fw
HTK/c3	Hat Lake	Pc	Fsc	Fsc	Fc	Fw
KHX	Kiskitto	Vsw	Vsw	Vsw	Vsw	Vaw
MDR	Medard	Pws	Pws	Pws	Pws	Pwa
MDRp	Medard, peat phase	Psw	Psw	Psw	Psw	Paw
NKL*	Nekik Lake	Vsw	Vsw	Vsw	Vsw	Vaw
PCP/d1	Partridge Crop	Psc	Fs	G	G	G
PCP/f2	Partridge Crop	Vt	Fsc	Pt	Ft	Pt
PKW	Pakwa	Ps	Vs	Vs	Vs	Fw
PPU/cx	Pipun	Ps	Fs	Fs	Fs	Paf
PPU/d2	Pipun	Pst	Fs	Fs	Fs	Paf

Map Symbol and Phase	Soil Name	Play-ground (18)	Picnic Area (19)	Camp Area (20)	Paths & Trails (21)	Permanent Bldgs. without Basements (11)
REX	Reed Lake	Vsw	Vsw	Vsw	Vsw	Vaw
RLX	Rock Island	Vsw	Vsw	Vsw	Vsw	Vaw
ROK	Roe Lake	Pws	Ps	Pws	Ps	Paf
ROK/cx	Roe Lake	Pws	Ps	Ps	Ps	Paf
ROK/c1	Roe Lake	Ps	Ps	Ps	Ps	Paf
ROK/dx	Roe Lake	Pst	Ps	Ps	Ps	Paf
ROK/ex	Roe Lake	Vt	Ps	Ps	Ps	Paf
SOW1/f3	Snow Lake	Vrt	Vr	Vr	Vr	Vrt
SOW1/g3	Snow Lake	Vrt	Vrt	Vr	Vr	Vrt
SOW1/i2	Snow Lake	Vrt	Vrt	Vrt	Vrt	Vrt
SOW1/i3	Snow Lake	Vrt	Vrt	Vrt	Vrt	Vrt
SOW2/e2	Snow Lake	Vr	Vr	Vr	Vr	Vr
SOW2/e3	Snow Lake	Vr	Vr	Vr	Vr	Vr
SOW2/f2	Snow Lake	Vrt	Vr	Vr	Vr	Vrt
SOW2/f3	Snow Lake	Vrt	Vr	Vr	Vr	Vrt
SOW2/g2	Snow Lake	Vrt	Vrt	Vrt	Vr	Vrt
SOW2/h2	Snow Lake	Vrt	Vrt	Vrt	Vr	Vrt
SOW2/h3	Snow Lake	Vrt	Vrt	Vrt	Vr	Vrt
SWK/c1	Sipiwesk	Fsk	Fs	Fsk	Fs	Paf
SWK/dx	Sipiwesk	Pt	Fs	Fsk	Fs	Paf
WBW	Wabowden	Fsk	Fs	Fsk	Fs	Paf
WBW/x1	Wabowden	Fsk	Fs	Fsk	Fsk	Paf
WBW/cx	Wabowden	Fst	Fs	Fsk	Fsk	Paf
WBW/c1	Wabowden	Fst	Fs	Fsk	Fsk	Paf
WBW/dx	Wabowden	Pt	Fs	Fsk	Fsk	Paf
WBW/d1	Wabowden	Pt	Fs	Fsk	Fsk	Paf
WSK	Waskik Lake	Vsw	Vsw	Vsw	Vsw	Vsw
WVT/d2	Wolverton	Ptc	Fc	Fc	Fc	Fd
WVT/e3	Wolverton	Vtc	Vct	Pct	Pct	Ptd
WVT/f2	Wolverton	Vtc	Fct	Pct	Pct	Ptd

* Frozen soils. Ratings for disturbed soil after permafrost has melted (unless otherwise indicated).

** SOW1 and SOW2 have been rated as bedrock. Locally areas occur within the map unit that are more suitable for a particular use than the rating indicates.

BIBLIOGRAPHY

Anon. 1986. Community Profile Information System. 1986. Manitoba's Economic Development Network, Portage la Prairie, Manitoba.

Clayton, J.S., W.A. Ehrlich, D.B. Cann, J.H. Day and I.B. Marshall. 1977. Soils of Canada, Vol. 1, Soils Report. Research Branch, Can. Dept. Agric., Ottawa.

CSSC. 1972. Proceedings of the Ninth Meeting of the Canada Soil Survey Committee, University of Saskatchewan, Saskatoon, 357 pp.

Davies, J.F., B.B. Bannatyne, G.S. Barry and H.R. McCabe. 1962. Geology and Mineral Resources of Manitoba. Mines Branch, Dep. Mines & Nat. Res., Winnipeg, Manitoba.

Manitoba Ecoclimatic Regions Working Group. 1985. Revised 1987. Ecoclimatic Regions of Manitoba. Unp. Manuscript and Map.

McCormack, R.J. 1970. The Canada Land Inventory, Rep. No. 4, 2nd ed. Land Capability Classification for Forestry. Dept. Regional Economic Expansion, Ottawa.

Mills, G.F. 1980. Physiographic Division of Manitoba. Map, legend and accompanying extended legend. Unp. Canada-Manitoba Soil Survey, Winnipeg.

Rowe, J.S. 1972. Forest Regions of Canada. Pub. No. 1300, Dept. Environment, Can. For. Serv., Ottawa.

Tarnocai, C. 1975. Interim Soil Survey Report of the Cormorant Lake Area. Canada Soil Survey, Winnipeg.

USDA. 1971. Guide for Interpreting Engineering Uses of Soils. Soil Conservation Service, USDA SCS-45, 87 pp.

APPENDIX A

DETAILED DESCRIPTION AND ANALYSES
OF
SELECTED SOILS

Detailed Description and Analysis of an Atik Series Soil

Location: 14 UMR 3429/7924

Vegetation: Black spruce, labrador tea, rock cranberry, baked-apple berry, *Hylocomnium splendens*, Schreber's moss, reindeer lichen

Special Notes: Excavated area is close to bedrock. The area is a small remnant of a shallow bog. In some parts, peat rests directly onto bedrock; however, in most of the area the organic material overlies clay. The clayey subsoil contains some gravel washed from bedrock outcrop. Wood is present largely as rotted tree stems.

Site Description: A small shallow basin bog; moisture regime is aquic and soil drainage is poor.

Organic Soil Family: Terric Fibric Mesisol, silvic, dysic, very cold, aquic, clayey

Om1	0 to 15 cm; dark reddish brown (5YR 3/2 m), moderately fibered, moderately decomposed feathermoss and ericaceous shrub peat; few, hard woody fragments; nonsticky; very strongly acid; abrupt, wavy boundary to
Of1	15 to 25 cm; yellowish brown (10YR 5/6 m), strongly matted, nondecomposed Sphagnum moss peat; nonsticky; extremely acid; abrupt, wavy boundary to
Of2	25 to 40 cm, dark reddish brown (5YR 3/2 m), slightly decomposed Sphagnum and feathermoss peat; nonsticky; extremely acid; abrupt, broken boundary to
Om2	40 to 95 cm, black (5YR 1.5/1 m), massive, moderately decomposed feathermoss and herbaceous peat; very soft, coarse woody fragments; slightly sticky; extremely acid; abrupt, smooth boundary to
Cg	95 to 120 cm, dark gray to gray (5Y 4.5/1 m), massive, gritty clay loam; very strongly acid.

Analysis of Atik Series Soil

Hori-zon	Depth in cm	Tex-ture	Sand %	Silt %	Clay %	% Fiber		Pyro-phos-phate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Cal-cite %	Dolo-mite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Un-rubbed	Rubbed												Ca	Mg	K	Na	H
Om1	0-15	-	-	-	-	66	30	21.4	12	4.8	-	-	-	-	49.9	1.15	43.4	192.1	66.0	19.3	0.9	0.9	72.0
Of1	15-25	-	-	-	-	100	98	4.5	3	3.3	-	-	-	-	59.1	0.5	113.6	146.0	9.0	20.0	0.6	0.7	110.0
Of2	25-40	-	-	-	-	94	70	19.1	4	3.6	-	-	-	-	58.9	1.2	49.1	173.5	25.0	9.8	0.2	0.8	x
Om2	40-95	-	-	-	-	50	20	143.0	10	4.5	-	-	-	-	61.2	1.5	40.8	195.5	56.0	13.3	0.1	0.8	82.0
Cg	95-120	CL	43	23	34	-	-	-	-	4.7	0.1	-	-	-	0.8	0.05	17.9	19.5	9.7	4.9	0.4	0.1	9.4

Detailed Description and Analysis of Drunken Lake Series Soil

Location: 14 UMR 3330/8375

Special Notes: Small borrow pit on side of rock outcrop

Site Description: A discontinuous lacustrine veneer, blanket and pockets over hummocky bedrock. The moisture regime is subhumid and soil drainage is moderate. The soil is slowly pervious. The site is nonstony and moderately rocky.

Mineral Soil Family: Solonetzic Gray Luvisol, clayey over loamy, mixed clay, acid, weakly calcareous, cold, subhumid, lithic phase

LFH	4 to 0 cm; dark brown (7.5YR 3.5/2 m) and very dark grayish brown (10YR 3/2 d) moss and forest debris; slightly to moderately decomposed; moderately acid; abrupt, smooth boundary to
Ae	0 to 5 cm; grayish brown to brown (10YR 4/2.5 m) and light gray (10YR 7/1.5 d), clay loam; moderate, fine to medium, platy breaking to moderate to strong, fine to medium subangular blocky structure; sticky, friable, plastic consistence; very strongly acid; clear, wavy boundary to
AB	5 to 14 cm; grayish brown to light grayish brown (10YR 5.5/2 m) and pale brown (10YR 6/3 d), heavy clay; moderate, subangular blocky structure; very sticky, firm, very plastic consistence; very strongly acid; clear, wavy boundary to
Btnj	14 to 33 cm; grayish brown (2.5Y 5/2 m) and light brownish gray to very pale brown (10YR 6.5/2.5 d), heavy clay; weak, coarse columnar breaking to strong, medium to coarse subangular blocky structure; very sticky, firm, very plastic consistence; very strongly acid; clear, wavy boundary to
Bt	33 to 48 cm; light olive brown (2.5Y 5/4 m) and light brownish gray to grayish brown (10YR 5.5/2 d) clay; moderate, medium, subangular blocky structure; very sticky, firm, very plastic consistence; strongly acid; abrupt, wavy boundary to
Ck	48 to 56 cm; grayish brown to light yellowish brown (2.5Y 5.5/3 m) and light grayish brown to grayish brown (10YR 5.5/2 d) clay loam; massive breaking to weak, fine, platy structure (laminated); sticky, friable, plastic consistence; neutral; very weakly calcareous; clear, wavy boundary to
IICk1	56 to 68 cm; light grayish brown to grayish brown (2.5Y 5.5/2 m) and light gray (10YR 7/1.5 d) silt loam; few coarse fragments; massive breaking to weak, fine platy structure; slightly sticky, friable and slightly plastic consistence; slightly alkaline; moderately calcareous; abrupt, wavy boundary to
IICk2	68 to 76 cm; grayish brown (2.5Y 5/2 m) and light gray (10YR 7/1.5 d) loamy sand; few coarse fragments; moderate, fine to medium platy breaking to moderate to strong, fine to medium, subangular blocky structure; nonsticky, very friable, nonplastic consistence; slightly alkaline; very weakly calcareous; abrupt, smooth boundary to
IICk3	76 to 90 cm; grayish brown (2.5Y 5/2 m) and light gray (10YR 7/1 d) fine sandy loam; moderate to strong, fine, platy (laminated) structure; slightly sticky, friable, slightly plastic consistence; moderately alkaline; moderately calcareous; abrupt, smooth boundary to
R	

Analysis of Drunken Lake Series Soil

Hori-zon	Depth in cm	Tex-ture	Sand %	Silt %	Clay %	% Fiber		Pyro-phos-phate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Cal-cite %	Dolo-mite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Un-rubbed	Rubbed												Ca	Mg	K	Na	H
LFH	4-0	-	-	-	-	-	-	-	-	5.9	-	-	-	-	33.6	1.10	30.5	87.2	42.5	9.8	1.5	0.7	29.0
Ae	0-5	CL	33	32	35	-	-	-	-	4.8	0.1	-	-	-	1.4	0.08	18.0	14.2	4.6	3.6	0.6	0.1	8.8
AB	5-14	HC	7	18	75	-	-	-	-	4.8	0.1	-	-	-	1.0	0.08	13.2	27.0	8.8	8.4	1.2	0.1	9.6
Btnj	14-33	HC	2	37	61	-	-	-	-	4.8	0.1	-	-	-	0.6	0.05	10.6	24.7	9.6	8.5	0.9	0.2	9.2
Ck	48-56	CL	25	44	31	-	-	-	-	7.1	0.3	0.6	0.6	-	0.6	0.04	14.9	13.3	10.0	5.5	0.4	0.2	-
IICk1	56-68	SiL	32	51	17	-	-	-	-	7.5	0.3	9.4	9.4	-	0.8	0.05	15.5	9.1	12.2	4.1	0.2	0.3	-
IICk2	68-76	LS	77	17	6	-	-	-	-	7.7	0.2	0.8	0.8	-	0.1	0.01	15.0	2.4	5.7	1.6	0.1	0.1	-
IICk3	76-90	FSL	60	33	7	-	-	-	-	7.9	0.2	6.0	6.0	-	0.2	0.01	20.9	1.9	9.4	1.6	0.1	0.1	-

Detailed Description and Analysis of a Fay Lake Series Soil

Location: 14 UMR 3785/8005

Vegetation: Jack pine, black spruce, rock cranberry, blueberry, Schreber's moss, Hylocomnium splendens, reindeer lichens

Special Notes: Till layer over subdued hummocky bedrock with clay pockets in lows. Till depth varies. This area is in lee of bedrock outcrop. H layer is mainly charcoal. Area is generally bedrock with veneer.

Site Description: A till veneer over bedrock, complex, very gently sloping with a southeastern aspect. The soil site is on an upper slope location and the site has a level microtopography. Soil moisture regime is subhumid and soil drainage is well. The soil is moderately pervious. The site is very stony and moderately rocky and supports productive woodland.

Mineral Soil Family: Eluviated Dystric Brunisol; loamy skeletal, mixed nonclay; acid; cold; subhumid

LF	5 to 1 cm; dark reddish brown (5YR 2.5/2 m) and very dark brown to very dark grayish brown (10YR 2.5/2 d), slightly decomposed, moderately fibered, feathermoss and forest debris; abundant, fine, horizontal roots; lightly porous; strongly acid; abrupt, wavy boundary to
H	1 to 0 cm; black to very dusky red (2.5YR 2.5/1 m) and very dark gray (10YR 3/1 d), highly decomposed, amorphous; abundant, fine, horizontal roots; highly porous; extremely acid; abrupt, wavy boundary to
Ae	0 to 5 cm; grayish brown (10YR 5/2 m) and gray to light gray (10YR 6/1 d), loamy sand, very weak, fine platy structure; nonsticky, very friable, nonplastic consistence; abundant, medium, horizontal roots; highly porous; 30% cobbles; extremely acid; abrupt, wavy boundary to
Bm1	5 to 20 cm; dark yellowish brown (10YR 4/4 m) and pale brown (10YR 6/3 d), gritty, fine sandy loam; very weak, very fine to fine granular structure; slightly sticky, very friable, nonplastic consistence; abundant, medium, horizontal roots; moderately porous; 30% gravel and cobbles; very strongly acid; clear, irregular boundary to
Bm2	20 to 35 cm; yellowish brown (10YR 5/4 m) and light gray (10YR 7/1 d), fine sandy loam; weak, fine granular structure; slightly sticky, very friable, nonplastic consistence; abundant, medium, horizontal roots; moderately porous; 10% gravel; very strongly acid; gradual, irregular boundary to
BC	35 to 80 cm; yellowish brown (10YR 5/4 m) and light gray (10YR 7/1.5 d), loamy coarse sand; very weak, medium, subangular blocky breaking to single grain; nonsticky, very friable, nonplastic consistence; few, fine, oblique roots; moderately porous; 10% gravel; very strongly acid; gradual, wavy boundary to
C	80 to 100 cm; yellowish brown to light yellowish brown (10YR 5.5/4 m) and light gray (10YR 7/2 d), coarse sand; single grain structure; nonsticky, very friable, nonplastic consistence; weakly cemented; moderately porous; 20% gravel; strongly acid.

Analysis of Fay Lake Series Soil

Horizon	Depth in cm	Texture	Sand %	Silt %	Clay %	% Fiber		Pyrophosphate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Calcite %	Dolomite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Unrubbed	Rubbed												Ca	Mg	K	Na	H+
LF	5-1	-	-	-	-	-	-	-	-	5.4	-	-	-	-	52.5	1.1	47.7	100.5	38.0	19.3	1.4	0.8	45.0
H	1-0	-	-	-	-	-	-	-	-	4.2	-	-	-	-	32.2	1.3	25.1	82.3	13.5	13.5	0.7	0.8	57.0
Ae	0-5	LS	77	19	4	-	-	-	-	4.3	0.2	-	-	-	0.9	0.04	23.3	4.8	0.6	0.8	0.1	0.1	5.0
Bm1	5-20	FSL	74	22	4	-	-	-	-	4.7	0.1	-	-	-	1.1	0.05	23.3	7.5	0.6	0.4	0.1	0.1	8.8
Bm2	20-35	FSL	67	28	5	-	-	-	-	4.6	0.1	-	-	-	0.5	0.02	20.4	5.6	0.3	0.3	0.0	0.1	6.2
BC	35-80	LCS	86	13	1	-	-	-	-	4.8	0.1	-	-	-	0.1	0.01	20.0	2.5	0.2	0.2	0.0	0.2	2.6
C	80-100	CS	89	10	1	-	-	-	-	5.2	0.0	-	-	-	0.1	0.01	16.3	2.7	0.2	0.1	0.1	0.1	1.4

Detailed Description and Analysis of File Lake Variant Soil

Location: 14 UMR 3666/8220

Vegetation: Black spruce, tamarack, willow, Labrador tea, blueberry, baked-apple berry, horsetail, rock cranberry, small cranberry, reindeer lichens, sphagnum moss and Schreber's moss.

Special Notes: 20 cm deep layer of angular cobbles and stones underlies the peat. Woody material in lower part of Of layer. Some charcoal in Oh horizon.

Site Description: A fibric veneer bog overlying coarse loamy glacio-fluvial or till, gently sloping with northeastern aspect. The soil site is in the lower slope position and the site has a moderately mounded microtopography. Soil moisture regime is perhumid and soil drainage is poor and has an apparent water table.

Organic Soil Family: Terric Humic Fibrisol, sphagnic, euic, very cold, perhumid, loamy skeletal, terric layer

Of	0 to 40 cm; yellowish red (5YR 4/6 m) and pink (7.5YR 7/4 d), none to slightly decomposed Sphagnum moss (35%) and soft, woody fragments (15%); extremely acid; abrupt, wavy boundary to
Oh	40 to 50 cm; black (5YR 2/1 m) and dark reddish brown (5YR 2/2 d) highly decomposed, amorphous peat; slightly sticky, very friable, nonplastic consistence; moderately acid; clear, wavy boundary to
Ahg	50 to 75 cm; black (10YR 2/1 m) and dark gray (10YR 4/1 d) skeletal silt loam; massive structure; sticky, friable, slightly plastic consistence; 40% angular cobbly coarse fragments; moderately acid; clear, wavy boundary to
Cg	75 to 100 cm; dark gray (5Y 4/1 m) and light gray (5Y 7/2 d) silt loam; mottles; massive structure; slightly sticky, friable, slightly plastic consistence; strongly acid.

Analysis of File Lake Complex Soil

Hori- zon	Depth in cm	Tex- ture	Sand %	Silt %	Clay %	% Fiber		Pyro- phos- phate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Cal- cite %	Dolo- mite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./ 100 g soil	Extractable Cations m.e./100 g soil				
						Un- rubbed	Rubbed												Ca	Mg	K	Na	H
Of	0-40	-	-	-	-	96	26	5.9	4	4.1	-	-	-	-	59.8	0.82	72.5	139.1	57.9	13.0	1.1	0.4	68.0
Oh	40-50	-	-	-	-	88	8	99.9	21	6.0	-	-	-	-	49.3	1.45	34.1	225.3	146.4	23.2	0.3	0.2	44.0
Ahg	50-75	SiL	31	57	12	-	-	-	-	5.6	0.3	-	-	-	7.4	0.23	32.8	32.9	21.7	3.5	0.1	0.1	12.2
Cg	75-100	SiL	38	56	6	-	-	-	-	5.3	0.2	-	-	-	-	-	-	4.6	2.4	0.6	0.1	0.1	1.4

Detailed Description and Analysis of a Nekik Lake Series Soil

Location: 14 UMR 3305/8352

Vegetation: Black spruce, Labrador tea, bunchberry, groundpine, Schreber's moss, Hylocomnium splendens

Special Notes: Collapsing peat plateau. Peat material is mostly accumulated in a sedge and shrub-fen environment

Site Description: A mesic plateau bog, complex, very gently sloping with a slightly mounded surface. Soil moisture regime is humid and soil drainage is imperfect. The soil is moderately pervious.

Organic Soil Family: Mesic Organic Cryosol, mesic, euic, very cold, perhumid

Of	0 to 15 cm, reddish brown (5YR 4/3 m), slightly decomposed feathermoss; extremely acid
Om1	15 to 35 cm; black (5YR 2.5/1 m), moderately decomposed, feathermoss (50%), needles (10%), herbs (15%), other (15%); 10% wood fragments; slightly acid
Om2	35 to 55 cm; dark reddish brown (5YR 3/2.5m), moderately decomposed, sedge (30%), brown mosses (50%), strongly matted; seasonal frost; very strongly acid
Om3	55 to 70 cm; very dark brown (10YR 2/2 m), moderately decomposed, sedge (30%), brown mosses (40%), feathermosses (20%), shrub fragments (10%); strongly acid
Omz1	70 to 100 cm; very dark brown (10YR 2/2 m), moderately decomposed, sedge (30%), brown mosses (40%), feathermosses (20%), shrub fragments (10%); ice lenses, moderately acid
Omz2	100 to 140 cm; reddish gray to reddish brown (5YR 2.5/2 m), moderately decomposed sedge and moss peat; moderately acid
Omz3	140 to 175 cm; dark brown (7.5YR 3/2 m), moderately decomposed sedge and moss peat; moderately acid
Omz4	175 to 230 cm; dark brown (7.5YR 3/2 m), moderately decomposed sedge and moss peat; ice lenses; moderately acid
Ofz1	230 to 255 cm; dark brown (7.5YR 3/2 m), slightly decomposed sedge and moss peat; woody fragments; high ice content; moderately acid
Omz5	255 to 315 cm; dark brown (10YR 3/3 m), moderately decomposed moss peat; moderately acid
Omz6	315 to 320 cm, dark brown (10YR 3/3 m), well decomposed peat; moderately acid
Cgz	320 to 350 cm, dark gray (5Y 4/1 m), heavy clay; many fine, distinct mottles; massive structure; slightly acid

Analysis of Nekik Lake Complex Soil

Horizon	Depth in cm	Texture	Sand %	Silt %	Clay %	% Fiber		Pyrophosphate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Calcite %	Dolomite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Unrubbed	Rubbed												Ca	Mg	K	Na	H
Of	0-15	-	-	-	-	58	42	13.2	3	3.0	-	-	-	-	66.1	1.19	55.6	102.9	14.3	5.5	0.9	0.9	75.0
Om1	15-35	-	-	-	-	56	24	59.5	9	6.3	-	-	-	-	55.8	2.63	21.2	182.3	121.0	24.8	0.2	0.8	37.0
Om2	35-55	-	-	-	-	42	20	39.6	11	4.6	-	-	-	-	54.2	3.55	15.3	176.9	69.8	11.3	0.1	0.8	74.0
Om3	55-70	-	-	-	-	54	26	47.8	13	5.2	-	-	-	-	57.4	2.37	24.2	157.8	68.3	17.5	0.1	1.0	68.0
Omz1	70-100	-	-	-	-	52	26	51.2	15	5.6	-	-	-	-	57.2	2.28	25.1	152.4	73.8	17.3	0.2	0.8	59.0
Omz2	100-140	-	-	-	-	50	28	70.8	17	5.7	-	-	-	-	53.8	2.44	22.0	162.2	89.6	17.7	0.2	0.9	55.0
Omz3	140-175	-	-	-	-	44	20	63.0	14	5.7	-	-	-	-	57.2	2.26	25.3	161.2	84.4	21.4	0.1	0.9	54.0
Omz4	175-230	-	-	-	-	44	16	27.8	10	6.7	-	-	-	-	60.7	2.56	23.8	152.9	75.4	21.5	0.1	0.9	54.0
Ofz	230-255	-	-	-	-	76	60	13.0	9	5.7	-	-	-	-	60.6	2.50	24.2	147.5	76.9	17.3	0.1	0.9	52.0
Omz5	255-315	-	-	-	-	56	28	21.0	13	5.7	-	-	-	-	59.5	2.45	24.5	133.3	66.5	16.7	0.1	0.9	49.0
Omz6	315-320	-	-	-	-	42	14	20.8	16	5.7	-	-	-	-	56.3	2.68	21.0	128.4	56.8	14.8	0.2	0.9	48.0
Cgz	320-350	HC	2	37	61	-	-	-	-	6.6	-	-	-	-	11.3	0.70	16.2	30.3	19.2	8.5	0.2	0.7	-

Detailed Description and Analysis of a Pakwa Series Soil

Location: 14 UMR 3343/7965

Vegetation: Trembling aspen, white spruce, speckled alder, rose, bunchberry, blueberry, bluebell, rock cranberry, maianthemum and grass

Site Description: A sandy, inclined, glacio-fluvial deposit, very gently sloping with a northern aspect. The soil site is located in the middle slope position and has level microtopography. Soil moisture regime is subhumid and soil drainage is imperfect. The soil is moderately pervious with an apparent water table. The site is nonstony and supports productive woodland.

Mineral Soil Family: Gleyed Eluviated Dystric Brunisol, sandy, mixed nonclay, neutral, cold, subhumid

LF	3 to 0 cm; black (5YR 2/1 m) and very dark gray (10YR 3/1 d) grass and herb litter; abundant, fine horizontal roots; neutral; abrupt, smooth boundary to
Ae	0 to 5 cm, brown (7.5YR 5/2 m) and gray to light gray (10YR 6/1 d), sand; single grain structure; nonsticky, loose, nonplastic consistence; abundant, fine, random roots; very strongly acid; highly porous; abrupt, wavy boundary to
Bm1	5 to 25 cm; reddish brown to yellowish red (5YR 5/5 m) and light yellowish brown (10YR 6/4 d), gritty sand; single grain structure; nonsticky, very friable, nonplastic consistence; abundant, fine, random roots; highly porous; strongly acid; clear, wavy boundary to
Bm2	25 to 40 cm; strong brown (7.5YR 5/6 m) and very pale brown to yellow (10YR 7/5 d), fine sand; single grain structure; nonsticky, very friable, nonplastic consistence; few, fine, vertical roots; moderately porous; moderately acid; gradual, wavy boundary to
BC	40 to 50 cm; pale brown to yellowish brown (10YR 5.5/3.5 m) and pale brown to very pale brown (10YR 6.5/3 d) fine sand; single grain structure; nonsticky, very friable, nonplastic consistence; very few, very fine, vertical roots; moderately porous; moderately acid; abrupt, wavy boundary to
Cgj1	50 to 80 cm; light olive brown to olive brown (2.5Y 4.5/4 m) and pale brown (10YR 6/3 d) fine sand; single grain structure; nonsticky, friable, nonplastic consistence; very few, very fine, vertical roots; neutral; gradual, smooth boundary to
Cgj2	80 to 110 cm; light olive brown to olive brown (2.5Y 4.5/4) and pale brown (10YR 6/3 d) fine sand; single grain structure; nonsticky, friable, nonplastic consistence; [illegible] neutral

Analysis of Pakwa Series Soil

Horizon	Depth in cm	Texture	Sand %	Silt %	Clay %	% Fiber		Pyrophosphate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Calcite %	Dolomite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Unrubbed	Rubbed												Ca	Mg	K	Na	H
LF	3-0	-	-	-	-	-	-	-	-	6.8	-	-	-	-	14.7	0.56	26.4	69.1	31.3	12.3	0.8	0.7	19.0
Ae	0-5	S	93	3	4	-	-	-	-	5.0	0.4	-	-	-	0.8	0.03	25.9	3.1	1.3	0.7	0.1	0.1	2.4
Bm1	5-25	S	94	2	4	-	-	-	-	5.5	0.2	-	-	-	0.4	0.02	18.6	5.4	1.2	0.7	0.2	0.1	3.8
Bm2	25-40	FS	95	1	4	-	-	-	-	5.6	0.1	-	-	-	0.2	0.01	15.4	3.7	1.1	0.6	0.2	0.1	3.0
BC	40-50	FS	96	1	3	-	-	-	-	6.0	0.1	-	-	-	0.1	0.01	15.6	2.0	1.2	0.5	0.1	0.1	2.2
Cgj1	50-80	FS	94	2	4	-	-	-	-	7.1	0.4	-	-	-	0.1	0.01	14.4	2.0	2.2	0.6	0.1	0.0	-
Cgj2	80-110	FS	96	1	3	-	-	-	-	7.2	0.4	-	-	-	0.1	0.01	15.6	2.1	2.3	0.5	0.1	0.1	-

Detailed Description and Analysis of a Soil of the Snow Lake Complex

Location: 14 UMR 3356/7976

Vegetation: White spruce, balsam fir, white birch, sarsparilla, squashberry, bunchberry, rose, twinflowers, bishop's cap, running clubmoss, schreber's moss, Hylocomnium splendens

Special Notes: Flagstones (exfoliated rock) at contact between LFH and mineral material

Site Description: A thin, loamy-skeletal veneer of till and residual materials over bedrock, complex, very strongly sloping with northeastern aspect. The soil site has level microtopography. Soil moisture regime is subhumid and soil drainage is well. The soil is moderately pervious. The site is very stony and excessively rocky and supports productive woodland.

Mineral Soil Family: Orthic Dystric Brunisol, loamy, mixed nonclay; extremely shallow lithic; acid; cold, subhumid, lithic phase

LFH	8 to 0 cm; black (5YR 2.5/1 m) and dark reddish brown (5YR 2.5/2 d), strongly fibered, moderately decomposed feathermoss, needles and leaves; abundant, very fine random roots; moderately acid; abrupt, smooth boundary to
Bm1	0 to 15 cm; dark reddish brown (2.5YR 3/4 m) and reddish brown (5YR 4/4 d), very fine sandy loam; weak, very fine granular structure; nonsticky, very friable and nonplastic consistence; abundant, fine, random roots, coarse cherty fragments; very strongly acid; clear, wavy boundary to
Bm2	15 to 25 cm; strong brown (7.5YR 4/6 m and 7.5YR 5/6 d), very fine sandy loam; weak, very fine granular structure; nonsticky, very friable and nonplastic consistence; abundant, medium, random roots; coarse cherty fragments; strongly acid; abrupt boundary to
R	

Analysis of Soil Belonging to Snow Lake Complex

Horizon	Depth in cm	Texture	Sand %	Silt %	Clay %	% Fiber		Pyrophosphate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Calcite %	Dolomite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Unrubbed	Rubbed												Ca	Mg	K	Na	H
LFH	8-0	-	-	-	-	-	-	-	-	-	5.8	-	-	-	55.7	1.82	30.6	128.8	79.6	17.9	1.0	0.2	31.0
Bm1	0-15	VFSL	53	38	9	-	-	-	-	-	4.6	-	-	-	6.7	0.26	26.3	26.0	9.6	1.9	0.3	0.1	14.2
Bm2	15-25	VFSL	64	30	6	-	-	-	-	-	5.3	-	-	-	4.1	0.19	21.9	23.5	15.4	3.4	0.2	0.1	16.4
R																							

Detailed Description and Analysis of a Wabowden Series Soil

Location: 14 UMR 3615/8122

Vegetation: Black spruce, trembling aspen, rose, raspberry, coltsfoot, maianthemum, fireweed, bunchberry, twinflower, coral-root, oneflower-pyrola, Hylocomnium splendens

Special Notes: Fine roots strongly concentrated on the surface planes of large structural peds. Moderately well developed Wabowden soil. Slope towards lake starts within short distance from pit: c and d slopes.

Site Description: A clayey lacustrine blanket, complex gently sloping with southeastern aspect. The soil site is in the middle slope position and has level microtopography. Soil moisture regime is subhumid and soil drainage is moderate. The soil is slowly pervious. The site is nonstony and supports productive woodland.

Mineral Soil Family: Solonetzic Gray Luvisol, fine clayey, mixed clay, neutral, strongly calcareous, cold, subhumid

LF	14 to 3 cm; black (5YR 2/1 m) and black to very dark brown (10YR 2.5/1.5), slightly decomposed, moderately fibered, feathermoss and forest debris; abundant, medium, horizontal roots; moderately acid; abrupt, wavy boundary to
H	3 to 0 cm; black (5YR 1.5/1 m) and very dark gray (10YR 3/1 d), highly decomposed, amorphous; abundant, coarse, horizontal roots; strongly acid; abrupt, smooth boundary to
Ae	0 to 7 cm; brown to pale brown (10YR 5.5/3 m) and light gray (10YR 7/2 d), clay loam; moderate to strong, medium to coarse platy structure; sticky, friable, plastic consistence; abundant coarse, horizontal roots; moderately porous; strongly acid; clear, wavy boundary to
AB	7 to 13 cm; brown to pale brown (10YR 5.5/3 m) and light gray (10YR 7/2.5 d), heavy clay; weak, very coarse platy breaking to strong, medium, subangular blocky structure; sticky, firm, very plastic consistence; abundant, fine roots; moderately porous; very strongly acid; clear, wavy boundary to
Btnj	13 to 40 cm; grayish brown to brown (10YR 5/2.5 m) and light yellowish brown (10YR 6/4 d), heavy clay; moderate, very coarse columnar breaking to moderate to strong, fine to medium, subangular blocky; sticky, firm, very plastic consistence; abundant, very fine roots; strongly acid; clear, irregular boundary to
Bt	40 to 50 cm; brown to dark brown (7.5YR 4/2 m) and brown (10YR 5/3 d), heavy clay; weak, very coarse columnar breaking to moderate to strong, fine subangular blocky; sticky, friable, very plastic consistence; plentiful, very fine roots; slightly acid; clear, irregular boundary to
BC	50 to 62 cm; brown to dark brown (7.5YR 4/2 m) and pale brown to very pale brown (10YR 6.5/3 d), heavy clay; massive structure breaking to weak, fine to medium, subangular blocky structure; sticky, friable, very plastic consistence; few, fine roots; moderately calcareous; slightly alkaline; gradual, irregular boundary to
Ck1	62 to 100 cm; brown to dark brown (10YR 4/3 m) and light brownish gray to light gray (10YR 6.5/2 d), heavy clay; massive structure breaking to weak, very fine to fine, subangular blocky structure; sticky, friable, very plastic consistence; very few, fine roots; moderately calcareous; few, spotted, coarse carbonate areas; slightly alkaline; gradual, wavy boundary to
Ck2	100 to 120 cm; dark grayish brown (10YR 4/2 m) and light gray (10YR 7/2 d), heavy clay; massive breaking to weak, very fine to fine, subangular blocky structure; sticky, friable, very plastic consistence; slightly alkaline; strongly calcareous; few, spotted, coarse carbonate areas.

Analysis of Wabowden Series Soil

Horizon	Depth in cm	Texture	Sand %	Silt %	Clay %	% Fiber		Pyrophosphate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Calcite %	Dolomite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Unrubbed	Rubbed												Ca	Mg	K	Na	H
LF	14-3	-	-	-	-	-	-	-	-	5.7	-	-	-	-	52.1	0.93	56.2	132.3	48.8	30.0	1.7	0.8	45.0
H	3-0	-	-	-	-	-	-	-	-	5.5	-	-	-	-	35.7	0.95	37.7	103.4	38.5	22.0	1.4	0.8	46.0
Ae	0-7	CL	33	32	35	-	-	-	-	5.1	0.3	-	-	-	2.8	0.13	20.6	26.0	7.9	5.6	0.7	0.1	10.8
AB	7-13	HC	3	19	78	-	-	-	-	5.0	0.2	-	-	-	1.6	0.11	14.4	34.5	15.2	8.9	0.9	0.2	11.4
Btnj	13-40	HC	1	16	83	-	-	-	-	5.1	0.1	-	-	-	0.8	0.08	10.5	39.0	15.5	11.0	0.9	0.3	11.6
Bt	40-50	HC	2	14	84	-	-	-	-	6.4	0.1	-	-	-	0.8	0.07	10.6	32.5	16.4	11.5	0.8	0.3	6.8
BC	50-62	HC	2	30	68	-	-	-	-	7.5	0.3	6.3	6.3	-	0.5	0.06	9.5	27.8	27.6	10.2	0.8	0.4	-
Ck1	62-100	HC	2	27	71	-	-	-	-	7.6	0.3	11.9	11.9	-	0.5	0.05	10.6	24.8	18.9	9.7	0.6	0.4	-
Ck2	100-120	HC	5	15	80	-	-	-	-	7.7	0.3	16.9	16.9	-	0.5	0.04	11.4	22.5	17.7	9.2	0.6	0.5	-

Detailed Description and Analysis of a Wolverton Series Soil

Location: 14 UMR 3802/7892

Vegetation: Black spruce, jack pine, blueberry, Schreber's moss and *Hylocomnium splendens*

Special Notes: Site is on north facing slope of a rock outcrop. Till veneer and blanket or rubble veneer. Because of the amount of coarse fragments depth to bedrock assumed but not determined.

Site Description: A till veneer, complex, strongly sloping, with a north aspect. The soil site is on the upper slope and has level microtopography. Soil moisture regime is semiarid and soil drainage is very good. The soil is rapidly pervious. The site is exceedingly stony and exceedingly rocky and supports productive woodland.

Mineral Soil Family: Eluviated Dystric Brunisol, sandy-skeletal, mixed nonclay, shallow lithic; acid; cold; semiarid, lithic phase

LF	10 to 0 cm; dark reddish brown (5YR 3/2 m) and dark brown to brown (7.5 YR 4/4 d), slightly to moderately decomposed mosses and needles; highly porous; abundant, coarse, horizontal roots; extremely acid; abrupt, wavy boundary to
Ae	0 to 15 cm; dark grayish brown (10YR 4/2 m) and light brownish gray (10YR 6/2 d), loamy coarse sand; cobbly and stony; single grain structure; nonsticky, loose and nonplastic consistence; abundant, fine, random roots; highly porous; extremely acid; abrupt, wavy boundary to
Bfj	15 to 50 cm; reddish brown (5YR 4/3.5 m) and reddish yellow (7.5YR 6/6 d), coarse sand; cobbly and stony; single grain structure; nonsticky, loose and nonplastic consistence; abundant, fine, random roots; highly porous; extremely acid
R	50 to 999 cm; bedrock

Analysis of Wolverton Soil

Horizon	Depth in cm	Texture	Sand %	Silt %	Clay %	% Fiber		Pyrophosphate x 100	% Ash	pH 0.01M $CaCl_2$	Cond. mS/cm	$CaCO_3$ Equiv. %	Calcite %	Dolomite %	Org. C %	Total N %	C/N Ratio	Exch. Cap. m.e./100 g soil	Extractable Cations m.e./100 g soil				
						Unrubbed	Rubbed												Ca	Mg	K	Na	H
LFH	10-0	-	-	-	-	-	-	-	-	3.1	-	-	-	-	53.2	0.97	55.0	99.0	9.0	2.8	1.7	0.8	73.0
Ae	0-15	LCS	83	10	5	-	-	-	-	3.7	0.1	-	-	-	1.8	0.07	24.7	6.8	0.9	0.4	0.1	0.1	11.2
Bfj	15-30	CS	93	3	4	-	-	-	-	4.1	0.1	-	-	-	0.9	0.04	23.0	6.4	0.7	0.2	0.1	0.1	7.2

Appendix B

GLOSSARY

AASHO classification (soil engineering) - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

Acid soil - A soil having a pH less than 7. See pH and Reaction, soil.

Alkaline soil - A soil having a pH greater than 7. See Reaction, soil.

Alluvium - A general term for all deposits of rivers and streams.

Arable soil - Soil suitable for plowing and cultivation.

Association - A sequence of soils of about the same age, derived from similar parent material, and occuring under similar climatic conditions but showing different characteristics due to variations in relief and in drainage.

1/3 Atmosphere Moisture - The moisture percentage on dry weight basis of a soil sample that has been air dried, screened, saturated and subjected to a soil moisture tension of 345 cm of water through a permeable membrane for a period of 48 hours. It approximates the soil moisture retention capacity.

Available nutrient - That portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

Available soil moisture - The portion of water in a soil that can be readily absorbed by plant roots: generally considered to be that water held in the soil up to approximately 15 atmospheres pressure.

Bearing capacity - Capacity of soil (in moist to wet conditions) to support loads such as buildings, people, vehicles, and animals.

Bedrock - The solid rock that underlies soil and regolith or that is exposed at the surface.

Boulders - Stones which are larger than 60 cm in diameter.

Bulk density - The weight of oven dry soil (105 degrees C) divided by its volume at field moisture conditions, expressed in grams per cubic centimeter.

Buried soil - Soil covered by an alluvial, loessial, or other deposit, usually to a depth greater than the thickness of the solum.

Calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with hydrochloric acid.

Calcium Carbonate Equivalent - Refers to the percent of carbonates in the soil expressed on the basis of calcium carbonate. Terms used to express the carbonate contents of soils are:

noncalcareous	<1%
weakly calcareous	1-5%
moderately calcareous	6-15%
strongly calcareous	16-25%
v. strongly calcareous	26-40%
extremely calcareous	>40%

Capillary fringe - A zone of essentially saturated soil just above the water table. The size distribution of the pores determines the extent and degree of the capillary fringe.

Carbon-nitrogen ratio (C/N ratio) - The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

Cation Exchange Capacity (**CEC**) - A measure of the total amount of exchangeable cations that can be held by a soil. Expressed in milliequivalents per 100g of soil.

Clay - As a soil separate, the mineral soil particles less than 0.002 mm in diameter: usually consisting largely of clay minerals. As a soil textural class, soil materials that contain 40 or more percent clay, less than 45 percent sand and less than 40 percent silt.

Cobbles - Rock fragments 8 to 25 cm in diameter.

Color - Soil colors are compared with a Munsell color chart. The Munsell system specifies the relative degrees of the three simple variables of color: hue, value and chroma. For example: 10YR 6/4 means a hue of 10YR, a value of 6, and a chroma of 4.

Complex (**soil**) - A mapping unit used in detailed and reconnaissance soil surveys where two or more soil series that are so intimately intermixed in an area that it is impractical to separate them at the scale of mapping used.

Concretions - Hard grains, pellets or nodules from concentration of compounds in the soil that cement soil grains together.

Conductivity, electrical - A physical quantity that measures the readiness with which a medium (irrigation water and soil extracts) transmits electricity. It expresses the concentration of salt in terms of the conductance (reciprocal of the electric resistance in ohms) in milliSiemens per cm (or expressed as deciSiemens per meter - dS/m).

Consistence (**soil**) - The mutual attraction of the particles in a soil mass, or their resistence to separation or deformation. It is described in terms such as loose, soft, friable, firm, hard, sticky, plastic or cemented.

Consumptive use factor (**CU**) - The ratio of consumptive use of water by a crop to potential evapotranspiration. and transpiration. An actively growing crop that completely covers the soil over a large area and that has an ample supply of readily available soil water has a consumptive use factor of 1.0.

Consumptive use of water - The sum of the depths of water transpired by the plants and evaporated from the soil surface and from intercepted precipitation. It may be less or greater than potential evapotranspiration.

Contour - An imaginary line connecting points of equal elevation on the surface of the soil.

Cover - This term generally has one of the following meanings:

1. Vegetation or other material providing protection
2. In forestry, low growing shrubs and herbaceous plants under trees (i.e., ground cover vs. tree cover)
3. Any vegetation producing a protective mat on or just above the soil surface.

Creep (soil) - Slow mass movement of soil and soil material down rather steep slopes primarily under the influence of gravity, but aided by saturation with water and by alternate freezing and thawing.

Decile portion - A one-tenth portion. As used in the soil map symbol A7-B3 means that the A soils cover seven tenths and the B soils cover three tenths of the map unit.

Delta - A fluvial or glaciofluvial fan shaped deposit at the mouth of a river that empties into a lake or sea.

Deflocculate - To separate or to break up soil aggregates into individual particles by chemical or physical means or both.

Degradation (of soils) - The changing of a soil to a more highly leached and more highly weathered condition, usually accompanied by morphological changes such as the development of an eluviated light colored (Ae) horizon.

Dispersion - Is rated high, moderate or low depending on how readily the soil structure breaks down or slakes because of excess moisture. A rating of high indicates that soil aggregates slake readily; a rating of low indicates that aggregates are resistant to dispersion and remain clumped together.

Drainage (soil) - (1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (2) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

Drainage in soil reports is described on the basis of actual moisture content in excess of field capacity and length of the saturation period within the plant root zone. The terms are as follows:

Very rapidly drained - Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall provided there is a steep gradient. Soils have very low available water storage capacity (usually less than 2.5 cm) within the control section and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Rapidly drained - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm) within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Well drained - Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm) within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations but additions are equaled by losses. These soils are usually free of mottles within 100 cm of the surface but may be mottled below this depth. Soil horizons are usually bright colored.

Moderately well drained - Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6cm) within the control section and are usually medium to fine in texture. Soils are commonly mottled in the 50 to 100 cm depth. Colors are dull brown in the subsoil with stains and mottles.

Imperfectly drained - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is major supply. If subsurface water or groundwater, or both, is the main source, flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface flow or groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well drained subgroups. These soils generally have mottling below the surface layers and generally have duller colors with depth, generally brownish gray with mottles of yellow and gray.

Poorly drained - Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Poorly drained soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, and Organic soils.

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important except where there is a perched water table with precipitation exceeding evapotranspiration. These soils have a wide range in available water storage capacity, texture, and depth, and are either Gleysolic or Organic.

Dryland farming - The practice of crop production in low rainfall areas without irrigation.

Eluvial horizon - A horizon from which material has been removed in solution or in water suspension.

Eolian - Soil material accumulated through wind action.

Erosion - The wearing away of the land surface by detachment and transport of soil and rock material through the action of moving water, wind or other geological processes. The ratings of erosion are:

Erosion 1	slightly eroded - soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B horizon or other lower lying horizons with surface soil in the plow layer.
Erosion 2	moderately eroded - soil with all of the A horizon and a part of the B or other lower lying horizons removed. The plow layer consists mainly of the original horizons below the A or below the original plow layer.
Erosion 3	severely eroded - soils have practically all of the original surface soil removed. The plow layer consists mainly of C horizon material, especially on knolls and steep upper slope positions.

Evapotranspiration - The combined loss of water from a given area, and during a specific period of time, by evaporation from the soil surface and transpiration from plants.

Field Moisture Equivalent - The minimum moisture content at which a drop of water placed on a smoothed surface of the soil will not be absorbed immediately by the soil, but will spread out over the surface and give it a shiny appearance.

Flood plain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fluvial deposits - All sediments past and present, deposited by flowing water, including glaciofluvial deposits.

Frost heave - The raising of the surface caused by ice in the subsoil.

Friable - Soil aggregates that are soft and easily crushed between thumb and forefinger.

Glaciofluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. These deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers and kame terraces.

Gleyed soil - An imperfectly or poorly drained soil in which the material has been modified by reduction or alternating reduction and oxidation. These soils have lower chromas or more prominent mottling or both in some horizons than the associated well-drained soil.

Gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas or prominent mottling or both, in some horizons.

Gravel - Rock fragments 2 mm to 7.5 cm in diameter.

Ground Moraine - An unsorted mixture of rocks, boulders, sand, silt and clay deposited by glacial ice. The predominant material is till; most till is thought to have accumulated under the ice by lodgment, but some till has been let down from the upper surface of the ice by ablation. Resorting and modification may have taken place to some extent by wave-action of glacial melt waters. The topography is most commonly in the form of undulating plains with gently sloping hills and enclosed depressions.

Groundwater - Water beneath the soil surface, usually under conditions where the voids are completely filled with water (saturation).

Halophytic vegetation - vegetation that grows naturally in soils having a high content of various salts. It usually has fleshy leaves or thorns and resembles desert vegetation.

Horizon (soil) - A layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil forming processes.

Horizon boundary - The lower boundary of each horizon is described by indicating its distinctness and form. The distinctness depends on the abruptness of vertical change (thickness). The form refers to the variation of the boundary plane.

Distinctness -
abrupt - less than 2 cm
clear - 2 to 5 cm
gradual - 5 to 15 cm
diffuse - more than 15 cm

Form -
smooth - nearly plain
wavy - pockets are wider than deep
irregular - pockets are deeper than wide
broken - parts of the horizon are unconnected with other parts

Humic layer - A layer of highly decomposed organic soil material containing little fibre.

Hydraulic Conductivity - Refers to the effective flow velocity or discharge velocity in soil at unit hydraulic gradient. It is an approximation of the permeability of the soil and is expressed in cm per hour. The classes are described in general or specific terms as:

High	>15	Very rapid	>50
		Rapid	15-50
Medium	0.5-15	Mod. rapid	5.0-15
		Moderate	1.5-5.0
		Mod. slow	0.5-1.5
Low	<0.5	Slow	0.15-0.5
		Very slow	0.015-0.15
		Extremely slow	<.015

Hydrologic cycle - The conditions through which water naturally passes from the time of precipitation until it is returned to the atmosphere by evaporation and is again ready to be precipitated.

Hydrophyte - Plants growing in water or dependent upon wet or saturated soil conditions for growth.

Illuvial horizon - A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. The layer of accumulation.

Impeded drainage - A condition that hinders the movement of water by gravity through the soils.

Inclusion - Soil type found within a mapping unit that is not extensive enough to be mapped separately or as part of a complex.

Infiltration - The downward entry of water into the soil

Irrigation - The artificial application of water to the soil for the benefit of growing crops.

Irrigation requirement (IR) - Refers to the amount of water exclusive of effective precipitation that is required for crop production.

Lacustrine deposits - Material deposited by or settled out of lake waters and exposed by lowering of the water levels or elevation of the land. These sediments range in texture from sand to clay and are usually varved (layered annual deposits).

Landforms - See Description of Landforms

Landscape - All the natural features such as fields, hills, forest, water, etc., which distinquish one part of the earth's surface from another part.

Leaching - The removal from the soil of materials in solution.

Liquid limit (upper plastic limit) - The water content corresponding to an arbitrary limit between the liquid and plastic states of consistency of a soil. The water content at this boundary is defined as that at which a pat of soil cut by a groove of standard dimensions will flow together for a distance of 1.25 cm under the impact of 25 blows in a standard liquid limit apparatus.

Lineal shrinkage - This is the decrease in one dimension expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from a stipulated percentage (usually field moisture equivalent) to the shrinkage limit.

Mapping Unit - Any delineated area shown on a soil map that is identified by a symbol. A mapping unit may be a soil unit, a miscellaneous land type, or a soil complex.

Marsh - Periodically flooded or continually wet areas having the surface not deeply submerged. It is covered dominantly with sedges, cattails, rushes or other hydrophytic plants.

Mature soil - A soil having well-developed soil horizons produced by the natural processes of soil formation.

Mesophyte - Plants requiring intermediate moisture conditions and are not very resistant to drought.

Microrelief - Small-scale, local differences in relief including mounds, swales or hollows.

Milliequivalent (me) - One-thousandth of an equivalent. An equivalent is the weight in grams of an ion or compound that combines with or replaces one gram of hydrogen. The atomic or formula weight divided by valence.

Mottles - Irregularly marked spots or streaks, usually yellow or orange but sometimes blue. They are described in order of abundance (few, common, many), size (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottles in soils indicate poor aeration and lack of good drainage.

Organic carbon - Carbon derived from plant and animal residues.

Organic matter - The fraction of the soil which consists of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms and substances synthesized by the soil population. It is determined on soils that have been sieved through a 2.0 mm sieve. It is estimated by multiplying the organic carbon by a factor of 1.72.

Outwash - Sediments "washed out" beyond the glacier by flowing water and laid down in thin beds or strata. Particle size may range from boulders to silt.

Ovendry soil - Soil that has been dried at 105 degrees C until it has reached constant weight.

Parent material - The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

Particle size, soil - The grain size distribution of the whole soil including the coarse fraction. It differs from texture, which refers to the fine earth (less than 2mm) fraction only. In addition, textural classes are usually assigned to specific horizons whereas soil family particle-size classes indicate a composite particle size of a part of the control section that may include several horizons. See Textural Triangle at end of Glossary.

The particle-size classes for family groupings are as follows:

Fragmental Stones, cobbles and gravel, with too little fine earth to fill interstices larger than 1 mm.

Sandy-skeletal Particles coarser than 2 mm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the sandy particle-size class.

Loamy-skeletal Particles 2 mm-25 cm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the loamy particle-size class.

Clayey-skeletal Particles 2 mm-25 cm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the clayey particle-size class.

Sandy The texture of the fine earth includes sands and loamy sands, exclusive of loamy very fine sand and very fine sand textures; particles 2 mm- 25 cm occupy less than 35% by volume.

Loamy The texture of the fine earth includes loamy very fine sand, very fine sand, and finer textures with less than 35% clay; particles 2 mm-25 cm occupy less than 35% by volume.

Coarse-loamy. A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-loamy. A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

Coarse-silty. A loamy particle size that has less than 15% of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-silty. A loamy particle size that has less than 15% of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

Clayey. The fine earth contains 35% or more clay by weight and particles 2mm-25 cm occupy less than 35% by volume.

Fine-clayey. A clayey particle size that has 35-60% clay in the fine earth fraction.

Very-fine-clayey. A clayey particle size that has 60% or more clay in the fine earth fraction.

Ped - An individual soil aggregate such as granule, prism or block formed by natural processes (in contrast with a clod which is formed artificially).

Pedology - Those aspects of soil science involving constitution, distribution, genesis and classification of soils.

Percolation - The downward movement of water through soil; specifically, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of 1.0 or less.

Permafrost -

1. Perennially frozen material underlying the solum.

2. A perennially frozen soil horizon.

Permafrost table - The upper boundary of permafrost, usually coincident with the lower limit of seasonal thaw (active layer).

Permeability - The ease with which water and air pass through the soil to all parts of the profile. See hydraulic conductivity.

pH - The intensity of acidity and alkalinity, expressed as the negative logarithm of the hydrogen ion concentration. A pH of 7 is neutral, lower values indicate acidity and higher values alkalinity (see Reaction, soil).

Phase, soil - A soil phase is used to characterize soil and landscape properties that are not used as criteria in soil taxonomy. The major phase differentiae are: slope, erosion, deposition, stoniness, texture, salinity, and calcareousness.

Plastic Limit - The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil.

Plasticity Index - The numerical difference between the liquid and the plastic limit. The plasticity index gives the range of moisture contents within which a soil exhibits plastic properties.

Potential evapotranspiration (PE) - The maximum quantity of water capable of being lost as water vapor, in a given climate, by a continuous stretch of vegetation covering the whole ground and well supplied with water.

Profile, soil - A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil - The acidity or alkalinity of a soil. Soil reaction classes are characterized as follows:

extremely acid	pH <4.5
very strongly acid	4.5 to 5.0
strongly acid	5.1 to 5.5
medium acid	5.6 to 6.0
slightly acid	6.1 to 6.5
neutral	6.6 to 7.3
mildly alkaline	7.4 to 7.8
mod. alkaline	7.9 to 8.4
strongly alkaline	8.5 to 9.0
very strongly alkaline	>9.0

Regolith - The unconsolidated mantle of weathered rock and soil material on the earth's surface.

Relief - The elevation of inequalities of the land surface when considered collectively.

Runoff - The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

Saline Soil - A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 millisiemens/cm (ms/cm), the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5. Approximate limits of salinity classes are:

non-saline	0 to 4 ms/cm
weakly saline	4 to 8 mS/cm
mod. saline	8 to 15 ms/cm
strongly saline	>15 ms/cm

Salinization - The process of accumulation of salts in the soil.

Salt-Affected Soil - Soil that has been adversely modified for the growth of most crop plants by the presence of certain types of exchangeable ions or of soluble salts. It includes soils having an excess of salts, or an excess of exchangeable sodium or both.

Sand - A soil particle between 0.05 and 2.0 mm in diameter. The textural class name for any soil containing 85 percent or more of sand and not more than 10 percent of clay.

Saturation Percentage - The moisture percentage of a saturated soil paste, expressed on an oven dry weight basis.

Seepage -

1. The escape of water downward through the soil.

2. The emergence of water from the soil along an extensive line of surface in contrast to a spring where water emerges from a local spot.

Series, soil - A category in the Canadian System of Soil Classification. It consists of soils that have soil horizons similar in their differentiating characteristics and arrangement in the profile, except for surface texture and are formed from a particular type of parent material.

Shrinkage limit - This is the moisture content at which an equilibrium condition of volume change is reached and further reduction in moisture content will not cause a decrease in the volume of the soil mass.

Shrinkage ratio - This is the ratio between the volume change and a corresponding change in moisture content. It equals the apparent specific gravity of the dried soil.

Silt - (a) Individual mineral particles of soil that range in diameter between 0.05 to .002 mm. (b) Soil of the textural class silt contains greater than 80 percent silt and less than 12 percent clay.

Slickenside - Smoothed surfaces along planes of weakness resulting from the movement of one mass of soil against another in soils dominated by swelling clays.

Sodium-Adsorption Ratio (S.A.R.) - A ratio for soil extracts and irrigation waters used to express the relative activity of sodium ions in exchange reactions with other cations in the soil SAR = $Na/((Ca+Mg)/2)^{1/2}$ where the cation concentrations are expressed as milliequivalents per litre.

Soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Soil has been subjected to and influenced by genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and micro-organisms, and topography, all acting over a period of time.

Solum - The upper horizons of a soil above the parent material and in which the processes of soil formation are active. It usually comprises the A and B horizons.

Stones - Rock fragments greater than 25 cm in diameter.

Stoniness - The percentage of land surface occupied by stones. The classes of stoniness are defined as follows:

Stones 0. Nonstony -- Land having less than 0.01% of surface occupied by stones.

Stones 1. Slightly stony -- Land having 0.01-0.1% of surface occupied by stones. Stones 15-30 cm in diameter, 10-30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. Moderately stony -- Land having 0.1-3% of surface occupied by stones. Stones 15-30 cm in diameter, 2-10 m apart. Stones cause some interference with cultivation.

Stones 3. Very stony -- Land having 3-15% of surface occupied by stones. Stones 15-30 cm in diameter, 1-2 m apart. There are sufficient stones to constitute a serious handicap to cultivation.

Stones 4. Exceedingly stony -- Land having 15-50% of surface occupied by stones. Stones 15-30 cm in diameter, 0.7-1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. Excessively stony -- Land having more than 50% of surface occupied by stones. Stones 15-30 cm in diameter, less than 0.7 m apart. The land is too stony to permit cultivation.

Storage Capacity - Refers to the maximum amount of readily available water that can be stored within the rooting zone of a crop in a given soil. For practical irrigation purposes, 50 percent of the total soil water between field capacity and wilting point may be considered as readily available.

Stratified materials - Unconsolidated sand, silt and clay arranged in strata or layers. In stratified materials, a bed is a unit layer distinctly separable from other layers and is one or more cm thick but a lamina is a similar layer less than 1 cm thick.

Structure - The combination or arrangement of primary soil particles into aggregates of secondary soil particles, units or peds, which are separated from each other by surfaces of weakness. Structure is expressed in terms of grade, size class and shape type. Grade refers to the distinctness of aggregate development, and is described as structureless, weak, moderate or strong. Structureless refers to the absence of observable aggregation of definite orderly arrangement; the term amorphous is used if soil is massive or coherent, single-grained if noncoherent. The weak to strong aggregates vary in size and are described by class as fine, medium, coarse, and very coarse depending on the shape types. The shape types refers to the dominant configuration of the aggregates and the way they are accommodated. The general shape types are plate-like, block-like and prism-like. The terms are:

Platy - Having thin, plate-like aggregates with faces mostly horizontal

Prismatic - Having prism-like aggregates with tops and edges, appear plane, level and somewhat angular.

Columnar - Having prism-like aggregates with vertical edges near the top of columns, not sharp.

Granular - Having block-like aggregates that appear as spheroids or polyhedrons having plane or curved surfaces which have slight or no accommodation to the faces of the surrounding peds.

Blocky - Having block-like aggregates with sharp, angular corners

Subangular blocky - Having block-like aggregates with rounded and flattened faces and rounded corners.

By convention an aggregate is described in the order of grade, class and type, e.g. strong, medium, blocky. In the parent material of soils the material with structural shapes may be designated as pseudo-blocky, pseudo-platy, etc.

Soil Survey - The systematic examination, description, classification, and mapping of soil in an area.

Sulfate Hazard - Refers to the relative degree of attack on concrete by soil and water containing various amounts of sulfate ions. It is estimated from electrolyte measurements and salt analysis on selected profiles and soil samples, and by visual examination of free gypsum within the profile during the course of soil investigation.

Swamp - See Description of Landforms

Texture, soil - The relative proportions of the fine earth (less than 2 mm.) fraction of a soil. Textural classes are usually assigned to specific horizons whereas family particle size classes indicate a composite particle size of a portion of the control section that may include several horizons. See Texture Triangle at end of Glossary.

The size range of the constituent primary particles are as follows:

	Diameter (mm)
Very coarse sand. . . .	2.0-1.0
Coarse sand	1.0-0.5
Medium sand	0.5-0.25
Fine sand	0.25-0.10
Very fine sand. . . .	0.10-0.05
Silt.	0.05-0.002
Clay.	< 0.002
Fine clay	< 0.0002

Till, glacial - Unstratified glacial deposits consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Tilth - The physical condition of soil as related to its ease of tillage, fitness as a seedbed, and its impedance to seedling emergency and root penetration.

Topography - Refers to the percent slope and the pattern or frequency of slopes in different directions. A set of 10 slope classes are used to denote the dominant but not necessarily most abundant slopes within a mapping unit.

Slope Class	Slope Name	Percent slope	Approx. degrees
1	level	0-0.5	0
2	nearly level	.5-2.5	.3-1.5
3	very gentle	2-5	1-3
4	gentle	6-9	3.5-5
5	moderate	10-15	6-8.5
6	strong	16-30	9-17
7	very strong	31-45	17-24
8	extreme	46-70	25-35
9	steep	71-100	35-45
10	very steep	>100	>45

Underground runoff - (or seepage)-Water flowing towards stream channels after infiltration into the ground.

Unified Soil Classification System (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Urban Land - Areas so altered or obstructed by urban works or structures that identification of soils is not feasible.

Variant, soil - A soil whose properties are believed to be sufficiently different from other known soils to justify a new series name, but comprising such a limited geographic area that creation of a new series is not justified.

Varve - A distinct band representing the annual deposit in sedimentary materials regardless of origin and usually consisting of two layers, one thick light colored layer of silt and fine sand laid down in the spring and summer, and the other a thin, dark colored layer of clay laid down in the fall and winter.

Water balance, soil - Is the daily amount of readily available water retained by the soil. The daily soil-water balance is decreased by the amount that the daily consumptive use exceeds the daily rainfall. When daily rainfall exceeds the consumptive use, the daily balance increases by the amount of the difference unless the soil-water balance is at storage capacity, in which case the excess is assumed to be lost by runoff or deep percolation.

Water table - (groundwater surface; free water surface; groundwater elevation) Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

Water table depths - (cm) -

Generally High	<100
Very High	0-50
Moderately High	50-100
Medium High	100-150
Generally Low	>150
Medium Low	150-200
Low	>200
Moderately Low	200-300
Very Low	>300

Water-holding capacity - The ability of a soil to hold water against the force of gravity in a freely drained soil.

Weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

Xerophyte - Plants capable of surviving extended periods of soil drought.

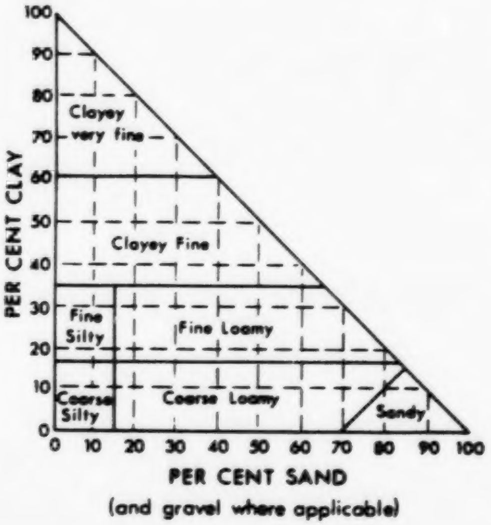
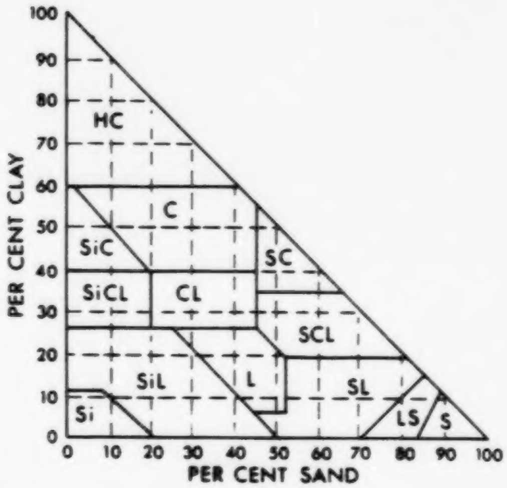


Figure 6: Family particle-size classes.



Texture Group	Class Symbol	Class Name
Coarse	S	sand
	LS	loamy sand
Moderately coarse	SL	sandy loam
	LVFS	loamy very fine sand
Medium	Si	silt
	SiL	silt loam
	L	loam
	VFSL	very fine sandy loam
Moderately fine	SCL	sandy clay loam
	CL	clay loam
	SiCL	silty clay loam
Fine	SC	sandy clay
	C	clay
	SiC	silty clay
Very fine	HC	heavy clay

Figure 7: Soil Textural Classes.

Appendix C

SOIL HORIZON DESIGNATIONS

ORGANIC HORIZONS

Organic horizons are found in Organic soils, and commonly at the surface of mineral soils. They may occur at any depth beneath the surface in buried soils, or overlying geologic deposits. They contain more than 17% organic carbon (approximately 30% organic matter) by weight. Two groups of these horizons are recognized, O horizons and the L, F, and H horizons.

O This is an organic horizon developed mainly from mosses, rushes, and woody materials.

Of The fibric horizon is the least decomposed of all the organic soil materials. It has large amounts of well-preserved fiber that are readily identifiable as to botanical origin. A fibric horizon has 40% or more of rubbed fiber by volume and a pyrophosphate index of 5 or more. If the rubbed fiber volume is 75% or more, the pyrophosphate criterion does not apply.

Om The mesic horizon is the intermediate stage of decompostion with intermediate amounts of fiber, bulk density and water-holding capacity. The material is partly altered both physically and biochemically. A mesic horizon is one that fails to meet the requirements of fibric or humic.

Oh The humic horizon is the most highly decomposed of the organic soil materials. It has the least amount of fiber, the highest bulk density, and the lowest saturated water-holding capacity. It is very stable and changes very little physically or chemically with time unless it is drained. The humic horizon has less than 10% rubbed fiber by volume and a pyrophosphate index of 3 or less.

LFH These organic horizons developed primarily from leaves, twigs, woody materials and a minor component of mosses under imperfectly to well drained forest conditions.

L This is an organic horizon characterized by an accumulation of organic matter in which the original structures are easily discernible.

F This is an organic horizon characterized by an accumulation of partly decomposed organic matter. The original structures in part are difficult to recognize. The horizon may be partly comminuted by soil fauna as in moder, or it may be a partly decomposed mat permeated by fungal hyphae as in mor.

H This is an organic horizon characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This material differs from the F horizon by its greater humification chiefly through the action of organisms. It is frequently intermixed with mineral grains, especially near the junction with the mineral horizon.

MASTER MINERAL HORIZONS

Mineral horizons are those that contain less than 30% organic matter by weight as specified for organic horizons.

A This is a mineral horizon or horizons formed at or near the surface in the zone of leaching or removal of materials in solution and suspension or of maximum in situ accumulation of organic matter, or both. Included are:

1. horizons in which organic matter has accumulated as a result of biological activity (Ah);
2. horizons that have been eluviated of clay, iron, aluminum, or organic matter, or all of them (Ae);
3. horizons having characteristics of 1) and 2) above but transitional to underlying B or C (AB or A and B);
4. horizons markedly disturbed by cultivation or pasture (Ap).

B This is a mineral horizon or horizons characterized by one or more of the following:

1. an enrichment in silicate clay, iron, aluminum, or humus, alone or in combination (Bt,Bf,Bfh,Bhf, and Bh);
2. a prismatic or columnar structure that exhibits pronounced coatings or stainings and significant amount of exchangeable Na (Bn);
3. an alteration by hydrolysis, reduction, or oxidation to give a change in color or structure from horizons above or below, or both, and does not meet the requirements of 1) and 2) above (Bm,Bg).

C This is a mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (i) the process of gleying, and (ii) the accumulation of calcium and magnesium carbonates and more soluble salts (Cca,Csa,Cg, and C). Marl and diatomaceous earth are considered to be C horizons.

R This is consolidated bedrock that is too hard to break with the hands or to dig with a spade when moist and that does not meet the requirement of a C horizon. The boundary between the R layer and overlying unconsolidated material is called a lithic contact.

W This is a layer of water in Gleysolic, Organic, or Cryosolic soils. It is called a hydric layer in Organic soils.

LOWER-CASE SUFFIXES

b Buried soil horizon.

c A cemented (irreversible) pedogenic horizon. The ortstein of a Podzol, and a layer cemented by calcium carbonate and a duripan are examples.

ca A horizon with secondary carbonate enrichment where the concentration of lime exceeds that present in the unenriched parent material. It is more than 10 cm thick, and if it has a CaCO3 equivalent of less than 15 percent it should have at least 5 percent more CaCO3 equivalent than the parent material (IC). If it has more than 15 percent CaCO3 equivalent it should have 1/3 more CaCO3 equivalent than the IC. If no IC is present, this horizon is more than 10 cm thick and contains more than 5 percent by volume of secondary carbonates in concretions or soft, powdery forms.

cc Cemented (irreversible) pedogenic concretions.

e A horizon characterized by the eluviation of clay, iron, aluminum, or organic matter alone or in combination. When dry, it is usually higher in color value by 1 or more units than an underlying B horizon. It is used with A (Ae).

f A horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It usually has a hue of 7.5YR or redder or its hue is 10YR near the upper boundary and becomes yellower with depth. When moist, the chroma is higher than 3 or the value is 3 or less. It contains 0.6% or more pyrophosphate-extractable Al+Fe in textures finer than sand and 0.4% or more in sands (coarse sand, sand, fine sand, and very fine sand). The ratio of pyrophosphate-extractable Al+Fe to clay (less than 0.002mm) is more than 0.05 and organic C exceeds 0.5%. Pyrophosphate-extractable Fe is at least 0.3%, or the ratio of organic C to pyrophosphate-extractable Fe is less than 20, or both are true. It is used with B alone (Bf), with B and h (Bhf), with B and g (Bfg), and with other suffixes. The criteria for "f" do not apply to Bgf horizons. The following horizons are differentiated on the basis of organic carbon content: Bf - 0.5% to 5% organic carbon. Bhf-more than 5% organic carbon.

g A horizon characterized by gray colors, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less. It is used with A and e (Aeg); with B alone (Bg); with B and f (Bfg); with B, h, and f (Bhfg); with B and t (Btg); with C alone (Cg); with C and k (Ckg); and several others. In some reddish parent materials, matrix colors of reddish hues and high chromas may persist despite long periods of reduction. In these soils, horizons are designated as g if there is gray mottling or if there is marked bleaching on ped faces or along cracks.

Aeg This horizon must meet the definitions of A,e, and g.

Bg These horizons are analogous to Bm horizons but they have colors indicative of poor drainage and periodic reduction. They include horizons occurring between A and C horizons in which the main features are (i) colors of low chroma, that is: chromas of 1 or less, without mottles on ped surfaces or in the matrix if peds are lacking; or chromas of 2 or less in hues of 10YR or redder, on ped surfaces or in the matrix if peds are lacking, accompanied by more promi-

	nent mottles than those in the C horizon; or hues bluer than 10Y, with or without mottles on ped surfaces or in the matrix if peds are lacking. (ii) colors indicated in (i) and a change in structure from that of the C horizons. (iii) color indicated in (i) and illuviation of clay too slight to meet the requirements of Bt; or accumulation or iron oxide too slight to meet the limits of Bgf. (iv) colors indicated in (i) and removal of carbonates. Bg horizons occur in some Orthic Humic Gleysols and some Orthic Gleysols.
Bfg,	Bhfg, Btg, and others. When used in any of these combinations the limits set for f, hf, t, and others must be met.
Bgf	The dithionite-extractable Fe of this horizon exceeds that of the IC by 1% or more. Pyrophosphate-extractable Al + Fe is less than the minimum limit specified for 'f' horizons. This horizon occurs in Fera Gleysols and Fera Humic Gleysols, and possibly below the Bfg of gleyed Podzols. It is distinguished from the Bfg of gleyed Podzols on the basis of the extractability of the Fe and Al. The Fe in the Bgf horizon is thought to have accumulated as a result of the oxidation of ferrous iron. The iron oxide formed is not associated intimately with organic matter or with Al, and it is sometimes crystalline. The Bgf horizons are usually prominently mottled, with more than half of the soil material occurring as mottles of high chroma.
Cg,	Ckg, Ccag, Csg, Csag. When g is used with C alone, or with C and one of the lower-case suffixes k, ca, s, or sa, it must meet the difinition for C and for the particular suffix.
h	A horizon enriched with organic matter. It is used with A alone (Ah); or with A and e (Ahe); or with B alone (Bh); or with B and f (Bhf).
Ah	A horizon enriched with organic matter that either has a color value at least one unit lower than the underlying horizon or contains 0.5% more organic carbon than the IC, or both. It contains less than 17% organic carbon by weight.
Ahe	An Ah horizon that has undergone eluviation as evidenced, under natural conditions, by streaks and splotches of differing shades of gray and often by platy structure. It may be overlain by a darker-colored Ah and underlain by a lighter-colored Ae.
Bh	This horizon contains more than 1% organic carbon, less than 0.3% pyrophosphate-extractable Fe, and has a ratio of organic carbon to pyrophosphate-extractable Fe of 20 or more. Generally the color value and chroma are less than 3 when moist.
Bhf	Defined under 'f'.

j Used as a modifier of the suffixes e, f, g, n, and t to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies. For example Bfgj means a Bf horizon with weak expression of gleying; Bfjgj means a B horizon with weak expression of both 'f' and 'g' features.

Aej It denotes an eluvial horizon that is thin, discontinuous or slightly discernible.

Btj It is a horizon with some illuviation of clay, but not enough to meet the limits of Bt.

Btgj, Bmgj. Horizons that are mottled but do not meet the criteria of Bg.

Bfj It is a horizon with some accumulation of pyrophosphate-extractable Al and Fe but not enough to meet the limits of Bf.

Bntj or Bnj. Horizons in which development of solonetzic B properties is evident but insufficient to meet the limits for Bn or Bnt.

k Denotes the presence of carbonate, as indicated by visible effervescence when dilute HCl is added. Most often it is used with B and m (Bmk) or C (Ck), and occasionally with Ah or Ap (Ahk, Apk), or organic horizons (Ofk, Omk).

m A horizon slightly altered by hydrolysis, oxidation, or solution, or all three, to give a change in color or structure, or both. It has:

1. Evidence of alteration in one of the following forms:

   a) Higher chromas and redder hues than the underlying horizons.

   b) Removal of carbonates, either partially (Bmk) or completely (Bm).

2. Illuviation, if evident, too slight to meet the requirements of a Bt or a podzolic B.

3. Some weatherable minerals.

4. No cementation or induration and lacks a brittle consistence when moist. This suffix can be used as Bm, Bmgj, Bmk, and Bms.

n A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. It must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry. It is used with B, as Bn or Bnt.

p A horizon disturbed by man's activities, such as cultivation, logging, habitation, etc. It is used with A and O.

s A horizon with salts, including gypsum, which may be detected as crystals or veins, as surface crusts of salt crystals, by depressed crop growth, or by the presence of salt-tolerant plants. It is commonly used with C and k (Csk), but can be used with any horizon or combination of horizon and lowercase suffix.

sa A horizon with secondary enrichment of salts more soluble than calcium and magnesium carbonates, in which the concentration of salts exceeds that present in the unenriched parent material. The horizon is 10 cm or more thick. The conductivity of the saturation extract must be at least 4 ms/cm and must exceed that of the C horizon by at least one-third.

t An illuvial horizon enriched with silicate clay. It is used with B alone (Bt), with B and g (Btg), with B and n (Bnt), etc.

Bt A Bt horizon is one that contains illuvial layer-lattice clays. It forms below an eluvial horizon, but may occur at the surface of a soil that has been partially truncated. It usually has a higher ratio of fine clay to total clay than IC. It has the following properties:

1. If any part of an eluvial horizon remains and there is no lithologic discontinuity between it and the Bt horizon, the Bt horizon contains more total and fine clay than the eluvial horizons, as follows:

   a) If any part of the eluvial horizon has less than 15% total clay in the fine earth fraction (2mm) the Bt horizon must contain at least 3% more clay, e.g.,Ae 10% clay-Bt minimum 13% clay.

   b) If the eluvial horizon has more than 15% and less than 40% total clay in the fine earth fraction, the ratio of the clay in the Bt horizon to that in the eluvial horizon must be 1.2 or more, e.g., 20% clay increase in the Bt over Ae.

   c) If the eluvial horizon has more than 40% total clay in the fine earth fraction, the Bt horizon must contain at least 8% more clay than the eluvial horizon, e.g. Ae 50% clay; Bt at least 58% clay.

2. A Bt horizon must be at least 5 cm thick. In some sandy soils where clay accumulation occurs in the lamellae, the total thickness of the lamellae should be more than 10 cm in the upper 150 cm of the profile.

3. In massive soils the Bt horizon should have oriented clays in some pores and also as bridges between the sand grains.

4. If peds are present, a Bt horizon shows clay skins on some of the vertical and horizontal ped surfaces and in the fine pores, or shows oriented clays in 1% or more of the cross section, as viewed in thin section.

5. If a soil shows a lithologic discontinuity between the eluvial

horizon and the Bt horizon, or if only a plow layer overlies the Bt horizon, the Bt horizon need show only clay skins in some part, either in some fine pores or on some vertical and horizontal ped surfaces. Thin sections should show that some part of the horizon has about 1% or more of oriented clay bodies.

Btj, Btj, and Btg are defined under j and g.

u A horizon that is markedly disrupted by physical or faunal processes other than cryoturbation. Evidence of marked disruption such as the inclusion of material from other horizons, absence of the horizon, etc. must be evident in at least half of the cross section of the pedon. Such turbation can result from blowdown of trees, mass movement of soil on slopes, and burrowing animals. It can be used with any horizon or subhorizon with the exception of A or B alone; e.g. Aeu, Bfu, BCu.

x A horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content. When dry, it has a hard consistence and seems to be cemented. When moist, it has moderate to weak brittleness. It frequently has bleached fracture planes and is overlain by a friable B horizon. Air dry clods of fragic horizons slake in water.

y A horizon affected by cryoturbation as manifested by disrupted and broken horizons,, incorporation of materials from other horizons and mechanical sorting in at least half of the cross section of the pedon. It is used with A, B, and C alone or in combination with other subscripts, e.g. Ahy, Ahgy, Bmy, Cy, Cgy, Cygj, etc.

z A frozen layer. It may be used with any horizon or layer, e.g. Ohz, Bmz, Cz, Wz.

Appendix D

DESCRIPTION OF LANDFORMS

C.1 GENETIC MATERIALS

Unconsolidated mineral component

The unconsolidated mineral component consists of clastic sediments that may or may not be stratified, but whose particles are not cemented together. They are essentially of glacial or post-glacial origin but include poorly consolidated and weathered bedrock.

Anthropogenic - Man-made or man-modified materials, including those associated with mineral exploitation and waste disposal.

Colluvial - Massive to moderately well stratified, nonsorted to poorly sorted sediments with any range of particle sizes from clay to boulders and blocks that have reached their present position by direct, gravity-induced movement.

They are restricted to products of mass-wasting whereby the debris is not carried by wind, water, or ice (excepting snow avalanches).

Eolian - Sediment, generally consisting of medium to fine sand and coarse silt particle sizes, that is well sorted, poorly compacted, and may show internal structures such as cross bedding or ripple laminae, or may be massive. Individual grains may be rounded and show signs of frosting.

These materials have been transported and deposited by wind action.

Fluvial - Sediment generally consisting of gravel and sand with a minor fraction of silt and clay. The gravels are typically rounded and contain interstitial sand. Fluvial sediments are commonly moderately to well sorted and display stratification, but massive, nonsorted fluvial gravels do occur. These materials have been transported and deposited by streams and rivers. Finer textured Fluvial deposits of modern rivers are termed Alluvium.

Lacustrine - Sediment generally consisting of either stratified fine sand, silt, and clay deposited on the lake bed; or moderately well sorted and stratified sand and coarser materials that are beach and other nearshore sediments transported and deposited by wave action.

These are materials that either have settled from suspension in bodies of standing fresh water or have accumulated at their margins through wave action.

Marine - Unconsolidated deposits of clay, silt, sand, or gravel that are well to moderately well sorted and well stratified to moderately stratified (in some places containing shells). They have settled from suspension in salt or brackish water bodies or have accumulated at their margins through shoreline processes such as wave action and longshore drift.

Morainal - Sediment generally consisting of well compacted material that is nonstratified and contains a heterogeneous mixture of particle sizes, often in a mixture of sand, silt, and clay that has been transported beneath, beside, on, within and in front of a glacier and not modified by any intermediate agent.

Saprolite - Rock containing a high proportion of residual silts and clays formed by alteration, chiefly by chemical weathering.

The rock remains in a coherent state, interstitial grain relationships are undisturbed and no downhill movement due to gravity has occurred.

Undifferentiated - A layered sequence of more than three types of genetic material outcropping on a steep erosional escarpment.

Volcanic - Unconsolidated pyroclastic sediments. These include volcanic dust, ash, cinders, and pumice.

Qualifying Descriptors

These have been introduced to qualify the genetic materials and to supply additional information about the mode of formation or depositional environment.

Glacial - Used to qualify nonglacial genetic materials or process modifiers where there is direct evidence that glacier ice exerted a strong but secondary or indirect control upon the mode of origin of the materials or mode of operation of the process. The use of this qualifying descriptor implies that glacier ice was close to the site of the deposition of a material or the site of operation of a process.

Glaciofluvial - Fluvial materials showing clear evidence of having been deposited either directly in front of or in contact with glacier ice.

Glaciolacustrine - Lacustrine materials deposited in contact with glacial ice.

Glaciomarine - Materials of glacial origin laid down in a marine environment, as a result of settling from melting, floating ice and ice shelves.

Organic component

The organic component consists of peat deposits containing >30% organic matter by weight that may be as thin as 10 cm if they overlie bedrock but are otherwise greater than 40 cm and generally greater than 60 cm thick. The classes and their definitions follow.

B	Bog
N	Fen
S	Swamp

Bog - A bog is a peat-covered or peat-filled area, generally with a high water table. Since the surface of the peatland is slightly elevated, bogs are either unaffected or partly affected by nutrient-rich groundwaters from the surrounding mineral soils. The groundwater is generally acidic and low in nutrients (ombrotrophic). The dominant peat materials are sphagnum and forest peat, underlain, at times, by fen peat.

Fen - A fen is a peat-covered or peat-filled area with a high water table, which is usually at the surface. The dominant materials are shallow to deep, well to moderately decomposed fen peat. The waters are mainly rich in nutrients (minerotrophic) and are derived from mineral soils. The peat materials are therefore higher in both nutrients and pH than the peats associated with bogs.

Swamp - A swamp is a peat-covered or peat-filled area. The peat surface is level or slightly concave in cross section. The water table is frequently at or above the peat surface. There is strong water movement from margins or other mineral sources. The microrelief is hummocky, with many pools present. The waters are neutral or slightly acid. The dominant peat materials are shallow to deep mesic to humic forest and fen peat.

C.2 GENETIC MATERIAL MODIFIERS

Material modifiers are used to qualify unconsolidated mineral and organic deposits. Particle-size classes serve to indicate the size, roundness, and sorting of unconsolidated mineral deposits. Fiber classes indicate the degree of decomposition and fiber size of organic materials.

Particle size classes for unconsolidated mineral materials

Blocky: An accumulation of angular particles greater than 256 mm in size.

Bouldery: An accumulation of rounded particles greater than 256 mm in size.

Clayey: An accumulation of particles where the fine earth fraction contains 35% or more clay (<0.002 mm) by weight and particles greater than 2 mm are less than 35% by volume.

Cobbly: An accumulation of rounded particles having a diameter of 64-256 mm.

Gravelly: An accumulation of rounded particles ranging in size from pebbles to boulders.

Loamy: An accumulation of particles of which fine earth fraction contains 35% or less clay (<0.002 mm) by weight and particles greater than 2 mm are less than 35% by volume.

Pebbly: An accumulation of rounded particles having a diameter of 2-64 mm.

Rubbly: An accumulation of angular fragments having a diameter of 2-256 mm.

Sandy: An accumulation of particles of which the fine earth fraction contains more than 70% by weight of fine sand or coarser particles. Particles greater than 2 mm occupy less than 35% by volume.

Silty: An accumulation of particles of which the fine earth fraction contains less than 15% of fine sand or coarser particles and has less than 35% clay. Particles greater than 2 mm occupy less than 35% by volume.

Fiber classes for organic materials

The amount of fiber and its durability are important characterizing features of organic deposits in that they reflect on the degree of decomposition of the material. The prevalence of woody materials in peats is also of prime importance.

Fibric: The least decomposed of all organic materials; there is a large amount of well-preserved fiber that is readily identifiable as to botanical origin. Fibers retain their character upon rubbing.

Mesic: Organic material in an intermediate stage of decompostion; intermediate amounts of fiber are present that can be identified as to their botanical origin.

Humic: Highly decomposed organic material; small amounts of fiber are present that can be identified as to their botanical origin. Fibers can be easily destroyed by rubbing.

Woody: Organic material containing more than 50% of woody fibers.

C.3 SURFACE EXPRESSION

The surface expression of genetic materials is their form (assemblage of slopes) and pattern of forms. Form as applied to unconsolidated deposits refers specifically to the product of the initial mode of origin of the materials. When applied to consolidated materials, form refers to the product of their modification by geological processes. Surface expression also indicates the manner in which unconsolidated genetic materials relate to the underlying unit.

Consolidated and Unconsolidated mineral surface classes

Apron - A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.

Blanket - A mantle of unconsolidated materials thick enough to mask minor irregularities in the underlying unit but still conforming to the general underlying topography.

Fan - A fan-shaped form similar to the segment of a cone and having a perceptible gradient from the apex to the toe.

Hummocky - A very complex sequence of slopes extending from somewhat rounded depressions or kettles of various sizes to irregular to conical knolls or knobs. There is a general lack of concordance between knolls or depressions. Slopes are generally 9-70% (5-35 degrees).

Inclined - A sloping, unidirectional surface with a generally constant slope not broken by marked irregularities. Slopes are 2-70% (1-35 degrees). The form of inclined slopes is not related to the initial mode of origin of the underlying material.

Level - A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than 2% (1 degree).

Rolling - A very regular sequence of moderate slopes extending from rounded, sometimes confined concave depressions to broad, rounded convexities producing a wave-lake pattern of moderate relief. Slope length is often 1.6 km or greater and gradients are greater than 5% (3 degrees).

Ridged - A long, narrow elevation of the surface, usually sharp crested with steep sides. The ridges may be parallel, subparallel, or intersecting.

Steep - Erosional slopes, greater than 70% (35 degrees), on both consolidated and unconsolidated materials. The form of a steep erosional slope on unconsolidated materials is not related to the initial mode of origin of the underlying material.

Terraced - Scarp face and the horizontal or gently inclined surface (tread) above it.

Undulating - A very regular sequence of gentle slopes that extends from rounded, sometimes confined concavities to broad rounded convexities producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant gradient of slopes is 2-5% (1-3 degrees).

Veneer - Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer will range from 10 cm to 1 m in thickness and will possess no form typical of the material's genesis.

Organic surface classes

Blanket - A mantle of organic materials that is thick enough to mask minor irregularities in the underlying unit but still conforms to the general underlying topography.

Bowl - A bog or fen occupying concave-shaped depressions.

Domed - A bog with an elevated, convex, central area much higher than the margin. Domes may be abrupt (with or without a frozen core) or gently sloping or have a stepped surface.

Floating - A level organic surface associated with a pond or lake and not anchored to the lake bottom.

Horizontal - A flat peat surface not broken by marked elevations and depressions.

Plateau - A bog with an elevated, flat, central area only slightly higher than the margin.

Ribbed - A pattern of parallel or reticulate low ridges associated with fens.

Sloping - A peat surface with a generally constant slope not broken by marked irregularities.

Veneer - A thin (40 cm-1m) mantle of organic materials which generally conforms to the underlying topography. They may or may not be associated with discontinuous permafrost.

APPENDIX E

GUIDES FOR EVALUATING SOIL SUITABILITY
FOR
SELECTED USES

Table 8. Guide for assessing soil suitability as source of topsoil.

The term "topsoil" includes soil materials used to cover barren surfaces exposed during construction, and materials used to improve soil conditions on lawns, gardens, flower beds, etc. The factors to be considered include not only the characteristics of the soil itself, but also the ease or difficulty of excavation, and where removal of topsoil is involved, accessibility to the site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence[2]	Very friable, friable	Loose, firm	Very firm	Cemented
i	Flooding	None	May flood occasionally for short periods	Frequent flooding	Constantly flooded
w	Wetness[2]	Wetness is not determining if better than very poorly drained.			Very poorly drained and permanently wet soils
t	Slope	0-5%	5-9%	9-15%	>15%
p	Stoniness[2]	Stones 10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones 0.1 m apart (Class 5)
c	Coarse fragments[2]: percent, by volume	<3%	3-15%	15-35%	>35%
s	Texture[2]	FSL, VFSL, L, SiL, SL, SC if 1:1 clay is dominant	CL, SCL, SiCL, SC if 2:1 clay is dominant; c and sic if 1:1 clay is dominant	S, LS, C and SiC if 2:1 clay is dominant. organic soils[3]	Marl, diatomaceous earth
b	Depth of Topsoil[4]	>40 cm	15-40 cm	8-15 cm	<8 cm
n	Salinity of Topsoil[5]	E.C. 0-1	E.C. 1-4	E.C. 4-8	E.C. >8

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[1] The symbols are used to indicate the nature of the limitation.

[2] For an explanation of texture, consistence, stoniness, coarse fragments and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3] Non-woody organic materials are assessed as good sources for topsoil if mixed with or incorporated into mineral soil.

[4] The remaining soil material (at least 8 cm) must be reclaimable after the uppermost soil is removed.

[5] E.C. = Electrical Conductivity (millisiemens/cm).

Table 9 . Guide for assessing soil suitability as source of sand and gravel.

The purpose of this table is to provide guidance for assessing the probable supply as well as quality of the sand or gravel for use as road base material and in concrete. The interpretation pertains mainly to the characteristics of the soil substratum to a depth of 150 cm, augmented by observations made in deep cuts as well as geological knowledge where available.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Unified Soil Group	SW SP GW GP	SW-SM SP-SM GP-GM GW-GM	SM SW-SC SP-SC GM GP-GC GW-GC	All other groups and bedrock
h	Depth to Seasonal Water Table	Not class determining if deeper than 50 cm		50 cm	
q	Depth to Sand and Gravel	<25 cm	25-75 cm[2]	>75 cm[2]	
p	Stoniness[3]	Not class determining if stones >.5 m apart (Class 0, 1, 2 and 3)		Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
d	Depth to Bedrock	>100 cm	50-100 cm	<50 cm	

[1] The symbols are used to indicate the nature of the limitation.

[2] Rated good if it is known that the underlying gravel or sand deposit is thick (>100 cm).

[3] For an explanation of stoniness and rockiness, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

Table 10 Guide for assessing soil suitability as source of roadfill.

Fill material for buildings or roads are included in this use. The performance of the material when removed from its original location and placed under load at the building site or road bed are to be considered. Since surface materials are generally removed during road or building construction their properties are disregarded. Aside from this layer, the whole soil to a depth of 150-200 cm should be evaluated. Soil materials which are suitable for fill can be considered equally suited for road subgrade construction.

Symbol[1]	Items Affecting Use[2]	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Subgrade[3]				
	a. AASHO group index[4]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC[5] and SC[5]	CL (with P.I.[6] <15) and ML	CL (with P.I.[6] of 15 or more), CH and MH[7]	OL, OH and Pt
l	Shrink-swell potential	Low	Moderate	High	
f	Susceptibility to frost action[8]	Low	Moderate	High	
t	Slope	0-15%	15-30%	30-45%	>45%
p	Stoniness[9]	Stones >2 m apart (Class 0, 1 and 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness[9]	Rock exposures >35 m apart and cover <10% of the surface	Rock exposure 10-35 m apart and cover 10-25% of the surface	Rock exposure 3.5-10 m apart and cover 25-50% of the surface	Rock exposures < 3.5 m apart and cover 50-90% of the surface
w	Wetness[9]	Excessively drained to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
d	Depth to Bedrock	>100 cm	50-100 cm	20-50 cm	<20 cm
h	Depth to Seasonal Water Table	>150 cm	75-150 cm	50-75 cm	<50 cm

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[1] The symbols are used to indicate the nature of the limitation.

[2] The first three items pertain to soil after it is placed in a fill; the last six items pertain to soil in its natural condition before excavation for road fill.

[3] This item estimates the strength of the soil material, that is, its ability to withstand applied loads.

[4] Use AASHO group index only where laboratory data are available for the kind of soil being rated; otherwise, use Unified soil groups.

[5] Downgrade suitability rating to fair if content of fines is more than about 30 percent.

[6] P.I. means plasticity index.

[7] Upgrade suitability rating to fair if MH is largely kaolinitic, friable, and free of mica.

[8] Use this item only where frost penetrates below the paved or hardened surface layer and where moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front.

[9] For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

Table 11 Guide for assessing soil suitability for permanent buildings[1].

This guide applies to undisturbed soils to be evaluated for single-family dwellings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundation requirements; but soil slope, susceptibility to flooding and other hydrologic conditions, such as wetness, that have effects beyond those related exclusively to foundations are considered too. Also considered are soil properties, particularly depth to bedrock, which influence excavation and construction costs for the building itself and for the installation of utility lines. Excluded are limitations for soil corosivity, landscaping and septic tank absorption fields.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability[3]			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[4]	With Basements: Very rapidly, rapidly and well drained. Without Basements: Very rapidly, rapidly, well and moderately well drained.	With Basements: Moderately well drained. Without Basements: Imperfectly drained.	With Basements: Imperfectly, poorly, and very poorly drained. Without Basements: Poorly and very poorly drained.	With Basements: Permanently wet soils. Without Basements: Permanently wet soils.
h	Depth to Seasonal Water Table	With Basements: >150 cm Without Basements: >75 cm	With Basements: 75-150 cm Without Basements: 50-75 cm	With Basements: 25-75 cm Without Basements: 25-50 cm	With Basements: <25 cm Without Basements: <25 cm
i	Flooding	None	None	Occasional flooding (once in 5 years)	Frequent flooding (every year)
t	Slope[5]	0-9%	9-15%	15-30%	>30%
a	Subgrade[6]				
	a. AASHO group index[7]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM and GC and SC	CL (with P.I.[8] <15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and Pt
f	Potential Frost Action[9]	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness[4]	Stones >10 m apart (Class 0 to 1)	Stones 2-10 m apart (Class 2[10])	Stones 0.1-2 m apart (Class 3[10] to 4)	Stones <0.1 m apart (Class 5[10])
r	Rockiness[4],[11]	Rock exposures >100 m apart and cover <2% of the surface	Rock exposures 30-100 m apart and cover 2-10% of the surface	Rock exposures <30 m apart and cover >10% of the surface	Rock exposures too frequent to allow location of permanent buildings
d	Depth to Bedrock[11]	With Basements: >150 cm Without Basements: >100 cm	With Basements: 100-150 cm Without Basements: 50-100 cm	With Basements: 50-100 cm Without Basements: <50 cm	With Basements: <50 cm

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[1] By halving the slope limits, this table can be used for evaluating soil suitability for buildings with large floor areas, but with foundation requirements not exceeding those of ordinary three-storey dwellings.

[2] The symbols are used to indicate the nature of the limitation.

[3] Some soils assessed as fair or poor may be good sites from an aesthetic or use standpoint, but they will require more site preparation and/or maintenance.

[4] For an explanation of rockiness, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Reduce the slope limits by one half for those soils subject to hillside slippage.

[6] This item estimates the strength of the soil, that is, its ability to withstand applied loads. When available, AASHO Group Index values from laboratory tests were used; otherwise the estimated Unified classes were used.

[7] Group index values were estimated from information published by the Portland Cement Association (PCA, 1962), pp. 23-25.

[8] P.I. means plasticity index.

[9] Frost heave only applies where frost penetrates to the assumed depth of the footings and the soil is moist. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5-8.

[10] Rate one class better for buildings without basements.

[11] Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment such as backhoes.

Table 12 Guide for assessing soil suitability for local roads and streets[1].

This guide applies to soils to be evaluated for construction and maintenance of local roads and streets. These are improved roads and streets having some kind of all-weather surfacing, commonly asphalt or concrete, and are expected to carry automobile traffic all year. They consist of: (1) the underlying local soil material (either cut or fill) called the subgrade; (2) the base material of gravel, crushed rock, or lime or soil cement stabilized soil called the subbase; and (3) the actual road surface or pavement, either flexible or rigid. They also are graded to shed water and have ordinary provisions for drainage. With the probable exception of the hardened surface layer, the roads and streets are built mainly from the soil at hand, and cuts and fills are limited, usually less than 2 meters. Excluded from consideration in this guide are highways designed for fast-moving, heavy trucks.

Properties that affect design and construction of roads and streets are: (1) those that affect the load supporting capacity and stability of the subgrade, and (2) those that affect the workability and amount of cut and fill. The AASHO and Unified Classification give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of hardrock, stoniness, rockiness, and wetness affect the ease of excavation and the amount of cut and fill to reach an even grade.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[3]	Very rapidly, rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained	Permanently wet soils
i	Flooding	None	Infrequent (once in 5 years)	Occasional (once in 2-4 years)	Frequent (every year)
t	Slope	0-9%	9-15%	15-30%	>30%
d	Depth to Bedrock[4]	>100 cm	50-100 cm	<50 cm	
a	Subgrade[5]				
	a. AASHO group index[6]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC[7] and SC[7]	CL (with P.I.[8] <15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and Pt
f	Susceptibility to Frost Heave[9]	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness[3]	Stones >2 m apart (Class 0 to 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[3]	Rock exposures >100 m apart and cover <2% of the surface	Rock exposures 30-100 m apart and cover 2-10% of the surface	Rock exposures <30 m apart and cover >10% of the surface	Rock exposures too frequent to permit location of roads and streets

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[1] These guidelines, with some adjustment of slope and rockiness limits, will also be useful for assessing soils for use as parking lots.

[2] Symbols are used to indicate the nature of the limitation.

[3] For an explanation of stoniness, rockiness and soil drainage classes, see the Canada Soil Information System (Canada Soil Survey Committee, 1978).

[4] Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment and is rippable by machinery.

[5] This item estimates the strength of soil materials as it applies to roadbeds. When available, AASHO Group Index values from laboratory tests were used; otherwise, the estimated Unified classes were used. The limitations were estimated assuming that the roads would be surfaced. On unsurfaced roads, rapidly drained, very sandy, poorly graded soils may cause washboard or rough roads.

[6] Group index values were estimated from information published by the Portland Cement Association (PCA, 1962) pp. 23-25.

[7] Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30 percent.

[8] P.I. means plasticity index.

[9] Frost heave is important where frost penetrates below the paved or hardened surface layer and moisture transportable by capillary movement is sufficient to form ice lenses at the freezing point. The susceptibility classes are taken from the United States Army Corps of Engineers (1962) pp. 5-8.

Table 13 Guide for assessing soil suitability for trench-type sanitary landfills[1].

The trench-type sanitary landfill is a sanitary landfill, in which dry garbage and trash is buried daily in an open trench and covered with a layer of soil material. Suitability of the site is dependent upon the potential for pollution of water sources through groundwater contact with the refuse, or leachate arising from the site. Those properties affecting ease of excavation of the site must be supplemented with geological and hydrological knowledge to provide subsurface soil and groundwater data to a depth of at least 3 to 4.5 m, a common depth of landfills.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability			
		Good - G[3]	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal High Water Table	Not class determining if more than 180 cm		100-180 cm	<100 cm
w	Wetness[4]	Not class determining if better than imperfectly drained		Imperfectly drained	Poorly and very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional	Frequent
k	Permeability[5]	<5 cm/hr	<5 cm/hr	5-15 cm/hr	>15 cm/hr
t	Slope	0-15%	15-30%	30-45%	>45%
s	Soil Texture[4],[6] (dominant to a depth of 150 cm)	SL, L, SiL, SCL	SiCL[7], CL, SC, LS	SiC, C	Muck, peat, gravel, sand
d	Depth to Hard Bedrock Rippable	>150 cm >150 cm	>150 cm 100-150 cm	100-150 cm 100-150 cm	<100 cm <100 cm
p	Stoniness[4]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones <0.1 m apart (Class 5)
r	Nature of Bedrock	Impermeable			Highly permeable, fractured, easily soluble

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[1] Based on soil depth (120 cm) commonly investigated in making soil surveys.

[2] The symbols are used to indicate the nature of the limitation.

[3] If probability is high that the soil material to a depth of 3 to 4.5 m will not alter a rating of good or fair, indicate this by an appropriate footnote, such as "Probably good to a depth of 3.5 m", or "Probably fair to a depth of 3.5 m".

[4] For an explanation of stoniness, texture and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Reflects ability of soil to retard movement of leachate from the landfills; may not reflect a limitation in arid and semiarid areas.

[6] Reflects ease of digging and moving (workability) and trafficability in the immediate area of the trench where there may not be surfaced roads.

[7] Soils high in expansive clays may need to be given a suitability rating of poor.

Table 14. Guide for assessing soil suitability for area-type sanitary landfills.

In the area-type sanitary landfill refuse is placed on the surface of the soil in successive layers. The daily and final cover material generally must be imported. A final cover of soil material at least 60 cm thick is placed over the fill when it is completed.

The soil under the proposed site should be investigated so as to determine the probability that leachates from the landfill can penetrate the soil and thereby pollute water supplies.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal Water Table[2]	> 150 cm	150-100 cm	50-100 cm	<50 cm
w	Wetness[2],[3]	Rapid to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional	Frequent
k	Permeability[4],[5]	Not class determining if less than 5 cm/hr		5-15 cm/hr	>15 cm/hr
t	Slope	0-9%	9-15%	15-30%	>30%

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[1] The symbols are used to indicate the nature of the limitation.

[2] Reflects influence of wetness on operation of equipment.

[3] For an explanation of drainage, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[4] Reflects ability of the soil to retard movement of leachate from landfills; may not reflect a limitation in arid and semiarid areas.

[5] Due to possible groundwater contamination, impermeable bedrock is considered poor and permeable bedrock is rated very poor for area-type sanitary landfills.

Table 15. Guide for assessing soil suitability as cover material for area-type sanitary landfills.

The term cover material includes soil materials used to put a daily and final covering layer on refuse in area-type sanitary landfills. This cover material may be derived from the area of the landfill or may be brought in from surrounding areas.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence[2]	Very friable, friable	Loose, firm	Very firm	Cemented
s	Texture[2],[3]	SL, L, SiL, SCL	SiCL, CL, SC, LS	SiC, C	Muck, peat, sand, gravel
d	Depth to bedrock[4]	>150 cm	100-150 cm	50-100 cm	<50 cm
c	Coarse fragments[2]	<15%	15-35%	>35%	
p	Stoniness[2]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
t	Slope	<9%	9-15%	15-30%	>30%
w	Wetness[2]	Not class determining if better than poorly drained		Poorly drained	Very poorly drained or permanently wet soils

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[1] The symbols are used to indicate the nature of the limitation.

[2] For an explanation of consistence, texture, coarse fragments, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3] Soils having a high proportion of non-expansive clays may be given a suitability rating one class better than is shown for them in this table.

[4] Thickness of material excluding topsoil, which will be stockpiled (see guide for topsoil).

Table 16 Guide for assessing soil suitability as source of roadfill.

Fill material for buildings or roads are included in this use. The performance of the material when removed from its original location and placed under load at the building site or road bed are to be considered. Since surface materials are generally removed during road or building construction their properties are disregarded. Aside from this layer, the whole soil to a depth of 150-200 cm should be evaluated. Soil materials which are suitable for fill can be considered equally suited for road subgrade construction.

Symbol[1]	Items Affecting Use[2]	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Subgrade[3]				
	a. AASHO group index[4]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC[5] and SC[5]	CL (with P.I.[6] <15) and ML	CL (with P.I.[6] of 15 or more), CH and MH[7]	OL, OH and Pt
l	Shrink-swell potential	Low	Moderate	High	
f	Susceptibility to frost action[8]	Low	Moderate	High	
t	Slope	0-15%	15-30%	30-45%	>45%
p	Stoniness[9]	Stones >2 m apart (Class 0, 1 and 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[9]	Rock exposures >35 m apart and cover <10% of the surface	Rock exposure 10-35 m apart and cover 10-25% of the surface	Rock exposure 3.5-10 m apart and cover 25-50% of the surface	Rock exposures <3.5 m apart and cover 50-90% of the surface
w	Wetness[9]	Excessively drained to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
d	Depth to Bedrock	>100 cm	50-100 cm	20-50 cm	<20 cm
h	Depth to Seasonal Water Table	>150 cm	75-150 cm	50-75 cm	<50 cm

[1] The symbols are used to indicate the nature of the limitation.

[2] The first three items pertain to soil after it is placed in a fill; the last six items pertain to soil in its natural condition before excavation for road fill.

[3] This item estimates the strength of the soil material, that is, its ability to withstand applied loads.

[4] Use AASHO group index only where laboratory data are available for the kind of soil being rated; otherwise, use Unified soil groups.

[5] Downgrade suitability rating to fair if content of fines is more than about 30 percent.

[6] P.I. means plasticity index.

[7] Upgrade suitability rating to fair if MH is largely kaolinitic, friable, and free of mica.

[8] Use this item only where frost penetrates below the paved or hardened surface layer and where moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front.

[9] For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

Table 17. Guide for assessing soil suitability for septic tank absorption fields.

This guide applies to soils to be used as an absorption and filtering medium for effluent from septic tank systems. A subsurface tile system laid in such a way that effluent from the septic tank is distributed reasonably uniformly into the natural soil is assumed when applying this guide. A rating of poor need not mean that a septic system should not be installed in the given soil, but rather, may suggest the difficulty, in terms of installation and maintenance, which can be expected.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
k	Permeability[2]	Rapid to moderately rapid	Moderate	Slow	Very slow
	Percolation Rate[3] (Auger hole method)	About 8-18 min/cm[3]	18-24 min/cm	Slower than 24 min/cm	
h	Depth to Seasonal Water Table[4]	>150 cm[5]	100-150 cm	50-100 cm	<50 cm
i	Flooding	Not subject to flooding	Not subject to flooding	Subject to occasional flooding (once in 5 years)	Floods every year
t	Slope	0-9%	9-15%	15-30%	>30%
d	Depth to Hard Rock, bedrock or other impervious materials	>150 cm	100-150 cm[6]	50-100 cm	<50 cm

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[1] The symbols are used to indicate the nature of the limitation.

[2] The suitability ratings should be related to the permeability of soil layers at and below depth of the tile line.

[3] Soils having a percolation rate less than about 8 min/cm are likely to present a pollution hazard to adjacent waters. This hazard must be noted, but the degree of hazard must, in each case, be assessed by examining the proximity of the proposed installation to water bodies, water table, and related features. The symbol g is used to indicate this condition. Refer to U.S. Dept. of Health, Education and Welfare (1969) for details of this procedure.

[4] Seasonal means for more than one month. It may, with caution, be possible to make some adjustment for the severity of a water table limitation in those cases where seasonal use of the facility does not coincide with the period of high water table.

[5] A seasonal water table should be at least 100 cm below the bottom of the trench at all times for soils rated Good (U.S. Dept. of Health, Education and Welfare, 1969). The depths used to water table are based on an assumed tile depth of 50 cm. Where relief permits, the effective depth above a water table or rock can be increased by adding appropriate amounts of fill.

[6] Where the slope is greater than 9%, a depth to bedrock of 100-150 cm is assessed as poor.

Table 18. Guide for assessing soil suitability for playgrounds.

This guide applies to soils to be used intensively for playgrounds for baseball, football, badminton, and for other similar organized games. These areas are subject to intensive foot traffic. A nearly level surface, good drainage, and a soil texture and consistence that gives a firm surface generally are required. The most desirable soils are free of rock outcrops and coarse fragments.

Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Symbol[1/]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2/]	Rapidly, well and moderately well drained soils with no ponding or seepage. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding of short duration and imperfectly drained soils. Water table below 50 cm during season of use.	Imperfectly drained soils subject to seepage or ponding, and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None during season of use.	Occasional flooding. May flood once every 2-3 years during season of use.	Floods every year during season of use.	Prolonged flooding during season of use.
k	Permeability	Very rapid to moderate.	Moderately slow and slow.	Very slow.	
t	Slope	0-2%	2-5%	5-9%	>9%
d	Depth to Bedrock	>100 cm	50-100 cm[3/]	<50 cm[3/]	
c	Coarse fragments on surface[2/]	Relatively free of coarse fragments.	<20% coarse fragments.	>20% coarse fragments.	
p	Stoniness[2/]	Stones >10 m apart. (Class 0 to 1)	Stones 2-10 m apart. (Class 2)	Stones 0.1-2 m apart. (Class 3, 4)	Stones <0.1 m apart. (Class 5)
r	Rockiness[2/]	Rock exposures >100 m apart and cover <2% of the surface.	Rock exposures 30-100 m apart and cover about 2-10% of the surface.	Rock exposures <30 m apart and cover >10% of the surface.	Rock outcrops too frequent to permit playground location.
s	Surface Soil Texture[2/],[4/]	SL, FSL, VFSL, L	SiL, CL, SCL, SiCL, LS	SC, SiC, C[5/]; S, Si	Peaty soils; S and LS subject to blowing.
q	Depth to Sand or Gravel[6/]	>100 cm	50-100 cm	<50 cm	
m	Useful Moisture[7/]	Water storage capacity[8/] >15.0 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8/] 7.5-15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8/] <7.5 cm and/or low rainfall and/or high evapotranspiration.	

[1/] The symbols are used to indicate the nature of the limitation.

[2/] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).
Coarse fragments for the purpose of this table include gravels and cobbles.

[3/] Downgrade to a very poor suitability rating if the slope is greater than 5%.

[4/] Surface soil texture influences soil ratings as it affects foot trafficability, surface wetness, dust, and maintenance. Adverse soil textures may be partially or completely overcome with the addition of topsoil.

[5/] Moderately well and well drained SC, SiC and C soils may be rated fair.

[6/] Depth to sand or gravel is considered a limitation in that levelling operations may expose sand or gravel, thereby bringing about adverse surface textures and undesirable amounts of coarse fragments. The addition of topsoil after the levelling process would overcome this limitation.

[7/] This item attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

[8/] Consult glossary for definitions of terms used.

Table 19 Guide for assessing soil suitability for picnic areas.

This guide applies to soils considered for intensive use as park-type picnic areas. It is assumed that most vehicular traffic will be confined to the access roads. Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Very rapidly, rapidly, well and moderately well drained soils not subject to seepage or ponding. Water table below 50 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding and imperfectly drained soils not subject to ponding or seepage. Water Table above 50 cm for short periods during season of use.	Imperfectly drained soils subject to seepage or ponding. Poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Very poorly drained and permanently wet soils.
f	Flooding	None during season of use.	May flood 1 or 2 times per year for short periods during season of use.	Floods more than 2 times during season of use.	Prolonged flooding during season of use.
t	Slope	0-9%	9-15%	15-30%	>30%
s	Surface Soil Texture[2],[3]	SL, FSL, VFSL, L	SiL, CL, SCL, SiCL, LS, and sand other than loose sand.	SC, SiC, C[4]; Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface[2]	0-20%	20-50%	>50%	
p	Stoniness[2]	Stones >2 m apart (Class 0 to 2)	Stones 1-2 m apart (Class 3)	Stones 0.1-1 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[2],[5],[6]	Rock exposures roughly 30-100 or more m apart and cover <10% of the surface.	Rock exposures roughly 10-30 m apart and cover 10-25% of the surface.	Rock exposures <10 m apart and cover >25% of the surface.	Rock exposures too frequent to permit location of picnic areas.
m	Useful Moisture[7]	Water storage capacity[8] >15 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5-15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] <7.5 cm and/or low rainfall and/or high evapotranspiration.	

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[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978). Coarse fragments for the purpose of this table, include gravels and cobbles. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.

[3] Surface soil texture influences soil ratings as it affects foot trafficability, dust and soil permeability.

[4] Moderately well and well drained SC, SiC and C soils may be rated fair.

[5] Very shallow soils are rated as having severe or very severe limitations for stoniness or rockiness.

[6] The nature and topography of the bedrock exposures may significantly alter these ratings. As such, on-site investigations will be necessary in map units containing bedrock when these are considered as possible sites.

[7] This item attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

[8] Consult glossary for definitions of terms used.

Table 2Q Guide for assessing soil suitability for camp areas.

This guide applies to soils to be used intensively for tents and camp trailers and the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping and levelling for campsites and parking areas. The soil should be suitable for heavy foot traffic by humans and limited vehicular traffic. Soil suitability for growing and maintaining vegetation is not a part of this guide, but is an important item to consider in the final evaluation of site.

Back country campsites differ in design, setting and management but require similar soil attributes. These guides should apply to evaluations for back country campsites but depending on the nature of the facility the interpreter may wish to adjust the criteria defining a given degree of limitation to reflect the changed requirement. For example, small tentsites may allow rock exposures greater than 10 m apart to be considered a slight limitation.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Very rapidly, rapidly, well and moderately well drained soils with no seepage or ponding. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding and imperfectly drained soils with no seepage or ponding. Water table below 50 cm during season of use.	Imperfectly drained soils subject to seepage or ponding and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None	Very occasional flooding during season of use. Once in 5-10 years.	Occasional flooding during season of use. Once in 2-4 years.	Flooding during every season of use.
k	Permeability	Very rapid to moderate inclusive.	Moderately slow and slow.	Very slow.	
t	Slope	0-9%	9-15%	15-30%	>30%
s	Surface Soil Texture[2],[3]	SL, FSL, VFSL, L	SiL, SCL, CL, SiCL, LS, and sand other than loose sand.	SC, SiC, C[4]; Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface[2],[5]	0-20%	20-50%	>50%	
p	Stoniness[2],[6]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness[2],[6]	No rock exposures	Rock exposures >10 m apart and cover <25% of the area.	Rock exposures <10 m apart and cover >25% of the area.	Rock exposures too frequent to permit campground location.

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[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3] Surface soil texture influences soil ratings as it affects foot trafficability, dust, and soil permeability.

[4] Moderately well and well drained SC, SiC and C soils may be rated fair.

[5] Coarse fragments for the purpose of this table include gravels and cobbles. Some gravelly soils may be rated as having slight limitations if the content of gravel exceeds 20% by only a small margin, providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.

[6] Very shallow soils are rated as having a limitation for rockiness and/or stoniness.

Table 21 Guide for assessing soil suitability for paths and trails.

It is assumed that the trails will be built at least 45 cm wide and that obstructions such as cobbles and stones will be removed during construction. It is also assumed that a dry, stable tread is desirable and that muddy, dusty, worn or eroded trail treads are undesirable. Hiking and riding trails are not treated separately, but as the design requirements for riding trails are more stringent, a given limitation will be more difficult to overcome. Poor or very poor suitability does not indicate that a trail cannot or should not be built. It does, however, suggest higher design requirements and maintenance to overcome the limitations.

Symbol[1/]	Items[2/] Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Texture[3/],[4/]	SL, FSL, VFSL, LS, L	SiL, CL, SiCL, SCL	SC, SiC, C[5/]; Sand, Si	Peaty soils; loose sand subject to blowing
c	Coarse Fragment Content[4/],[6/]	0-20%	20-50%	>50%	
p	Stoniness[4/]	Stones >2 m apart (Class 0 to 2)	Stones 1-2 m apart (Class 3)	Stones 0.1-1 m apart (Class 4)	Stones <0.1 m apart (Class 5)
w	Wetness[4/]	Very rapidly, rapidly well, and moderately well drained soils. Water table below 50 cm during season of use.	Moderately well drained soils subject to occasional seepage and ponding and imperfectly drained soils. Water table may be above 50 cm for short periods during season of use.	Poorly and very poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Permanently wet soils.
r	Rockiness[4/],[7/]	Rock exposures >30 m apart and cover <10% of the surface.	Rock exposures 10-30 m apart and cover 10-25% of the surface.	Rock exposures <10 m apart and cover >25% of the surface.	Rock exposures too frequent to permit location of paths and trails.
t	Slope[8/]	0-15%	15-30%	30-60%	>60%
i	Flooding	Not subject to flooding during season of use.	Floods 1 or 2 times during season of use.	Floods more than 2 times during season of use.	Subject to prolonged flooding during season of use.

[1/] The symbols are used to indicate the nature of the limitation.

[2/] The items affecting use listed in this table are those which have been shown to cause significant differences in trail response. Elevation, aspect, position on slope, and snow avalanching may have slight affects or influence trail management and should be considered in the final site evaluation. Items such as vegetation, fauna, and scenic value are not considered in the guidelines (Epp, 1977).

[3/] Texture refers to the soil texture which will form the tread texture. This is the surface texture on level areas but may be a subsurface texture on slopes. Textural classes are based on the less than 2 mm soil fraction. Texture influences soil ratings as it influences foot trafficability, dust, design or maintenance of trails, and erosion hazards.

[4/] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5/] Moderately well and well drained SC, SiC and C soils may be rated fair.

[6/] Coarse fragments for the purpose of this table, include gravels and cobbles. Gravels tend to cause unstable footing when present in high amounts, and are also associated with increased erosion. Cobbles (and stones) must be removed from the trail tread, increasing construction and maintenance difficulties. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix or (b) the fragments are less than 2 cm in size.

[7/] The type of rock outcrop (flat lying vs cliffs), and the orientation of the structure (linear cliffs vs massive blocks) can greatly alter the degree of the limitation. Each site with a Rockiness limitation based on the percent rock outcrop above should be evaluated on its own merits and the degree of limitation should then be modified appropriately if necessary.

[8/] Slope in this context refers to the slope of the ground surface, not the slope of the tread.

APPENDIX F

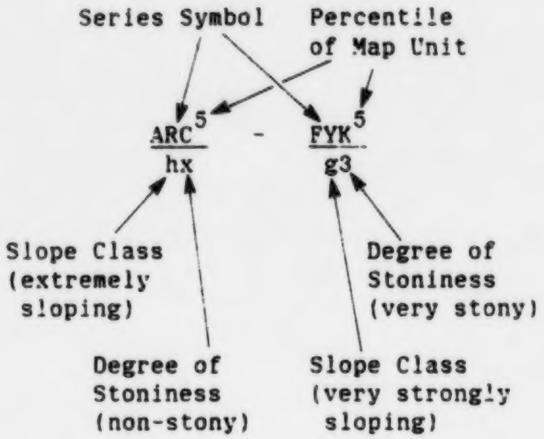
SOIL LEGEND FOR SNOW LAKE
AND
MAP UNIT SYMBOLOGY

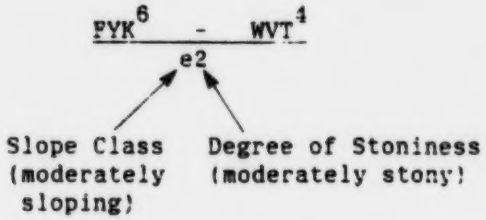
Table 22. Soils Legend for Snow Lake Study Area

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
ARC	Acidic Bedrock	-	Rapid	Intrusive & Volcanic	-	-
ATK	Atik	Mesic	P-V.Poor	Forest peat	Mesic/Clayey	TFI.M
BTW	Burntwood	CL-C	Well	Lacustrine	Clayey/Loamy	O.GL
DRL	Drunken Lake	CL-C	Well	Lacustrine	Clayey	O.GL, lithic
FLL	File Lake	Fibric	P-V.Poor	Forest peat	Mesic/S-SL	TFI.M
FXL	Flux Lake	Fibric	P-V.Poor	Forest peat	Mesic	FI.M, lithic
FYK	Fay Lake	LS	Well	Morainal	Coarse Loamy	E.DYB
GRY	Gormley Lake	Fibric	P-V.Poor	Forest peat	Mesic/LS-S	T.FIM
HGR	Hargrave	Fibric	P-V.Poor	Forest peat	Mesic	TY.M
HTK	Hat Lake	LS	Imperfect	Morainal	Coarse Loamy	GLE.DYB
KHX	Kiskitto	Fibric	P-V.Poor	Sphagnum peat	Fibric/Mesic	M.F
MDR	Medard	C	Poor	Lacustrine	Clayey	R.G
MDRp	Medard, peat phase	Mesic	Poor	Lacustrine	Clayey	R.G, peaty phase
NKL	Nekik Lake	Fibric	Imp.-Poor	Forest peat	Mesic	ME.OC
PKW	Pakwa	S	Imperfect	Glacio-fluvial	Sandy	GLE.DYB
PPU	Pipun	C-CL	Mod. Well	Lacustrine	Clayey/loamy	O.GL
REX	Reed Lake	Fibric	V.Poor	Fen peat	Mesic/clayey	T.M
RLX	Rock Island	Fibric	V.Poor	Fen peat	Mesic	TY.M
ROK	Roe Lake	C-CL	Imperfect	Lacustrine	Clayey	GL.GL
SOW1 & 2	Snow Lake	L	Well-Imp.	Morainal & Colluvial	Coarse loamy	E.DYB, lithic phase
SWK	Sipiwesk	C	Mod. Well	Lacustrine	Clayey	O.GL
WBW	Wabowden	C	Mod. Well	Lacustrine	Clayey	SZ.GL
WSK	Waskik Lake	Fibric	V. Poor	Fen Peat	Mesic	T.M
WVT	Wolverton	S	Well	Morainal	Coarse loamy	E.DYB, lithic phase

MAP UNIT SYMBOLOGY

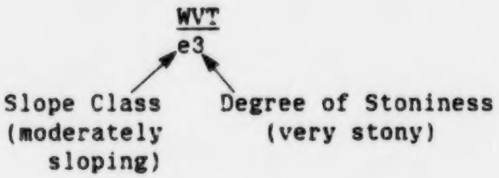
Compound Map Units

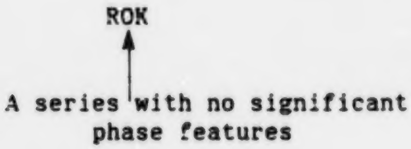

Series Symbol
Percentile of Map Unit
ARC5 - FYK5
hx
g3
Slope Class (extremely sloping)
Degree of Stoniness (non-stony)
Slope Class (very strongly sloping)
Degree of Stoniness (very stony)


FYK6 - WVT4
e2
Slope Class (moderately sloping)
Degree of Stoniness (moderately stony)

In a compound unit, where two series share the same denominator, the phases apply to both series accordingly.

Simple Map Units


WVT
e3
Slope Class (moderately sloping)
Degree of Stoniness (very stony)



Phases

Slope Class

x	0-2%	level to nearly level
c	2-5%	very gently sloping
d	5-9%	gently sloping
e	9-15%	moderately sloping
f	15-30%	strongly sloping
g	30-45%	very strongly sloping
h	45-70%	extremely sloping
i	70-100%	steeply sloping
j	>100%	very steeply sloping

Stoniness

x	non-stony
1	slightly stony
2	moderately stony
3	very stony
4	exceedingly stony
5	excessively stony

MAPS
NOT
FILMED

CARTES
OMISES